HIGHLIGHTS

REVISION NO. 33 Jun 01/10

Pages which have been revised are outlined below, together with the Highlights of the Revision

CH/SE/SU C PAGES	REASON FOR CHANGE	EFFECTIVITY
CHAPTER 77		
L.E.P. 1- 2	Revised to Reflect this revision indicating new,revised, and/or deleted pages	
77-12-21 401	Minor additions and amplification **REVISED C/B LOCATIONS.**	
77-32-02 401	Layout improved	

CHAPTER 77

ENGINE INDICATING

LIST OF EFFECTIVE PAGES

N, R or D indicates pages which are New, Revised or Deleted respectively
Remove and insert the affected pages and complete the Record of Revisions and the Record of Temporary Revisions as necessary

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RECORD OF TEMP. REVISION			
L.E.P.	R	1- 2	Jun01/10
T. of C.		1	Dec01/06
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T. of C.		3	Jun01/04
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CHAPTER 77

ENGINE INDICATING

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Printed in France

1. General (Ref. Fig. 004)
(Ref. Fig. 001)
(Ref. Fig. 002)

A. The engine indicating parameters are displayed in the flight compartment on indicators, ECAM displays or alarms, thus enabling the crew to monitor the engine.

B. The engine power management parameter display is ensured by :
- indicators : EPR, EGT, N1, N2, FF/FU and EPR limit Thrust Rating Panel (TRP) located on the main instrument panel (4VU), (Ref. Fig. 003).
- the FF/FU message on the ECAM display unit (Ref. 73-00-00, P. Block 1).

C. Warnings and messages are provided through :
- warning lights
- ECAM system display unit
located on the main instrument panel.

D. The engine monitoring parameters displayed on ECAM system display unit are :
- oil pressure, oil temperature, oil quantity, oil Δ temperature (Ref. 79-00-00)
- fuel pressure (Ref. 73-00-00)
- nacelle temperature (Ref. 75-00-00)
- vibration measuring of the LP (N1) and HP (N2) rotors (Ref. 77-00-00).

E. FADEC control
- The power management system is provided by the dual channel Full Authority Digital Electronic Engine Control (FADEC).
- The FADEC establishes engine thrust setting through direct closed loop control of engine pressure ratio (EPR), the prime thrust setting parameter.

One primary control mode is defined as that which utilizes EPR to control the thrust automatically. If the required resources are not available to operate on the EPR mode, the FADEC will automatically revert to the alternate control mode that controls on N1 rotor speed. The FADEC is designed to permit engine operation using N1 as an alternate thrust setting parameter. The FADEC is dispatchable when the alternate mode is selected. When the alternate mode is selected the EPR command is not displayed.

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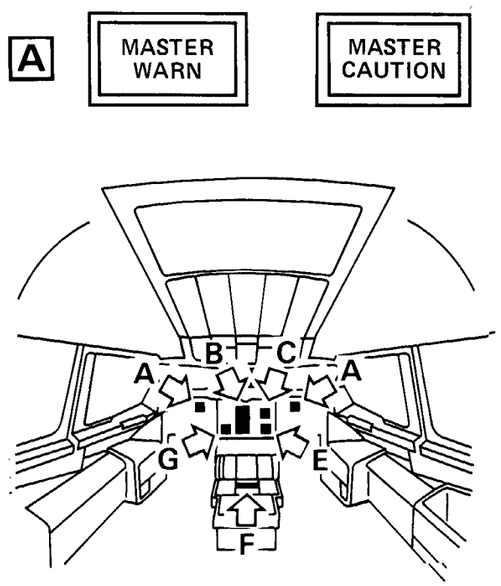

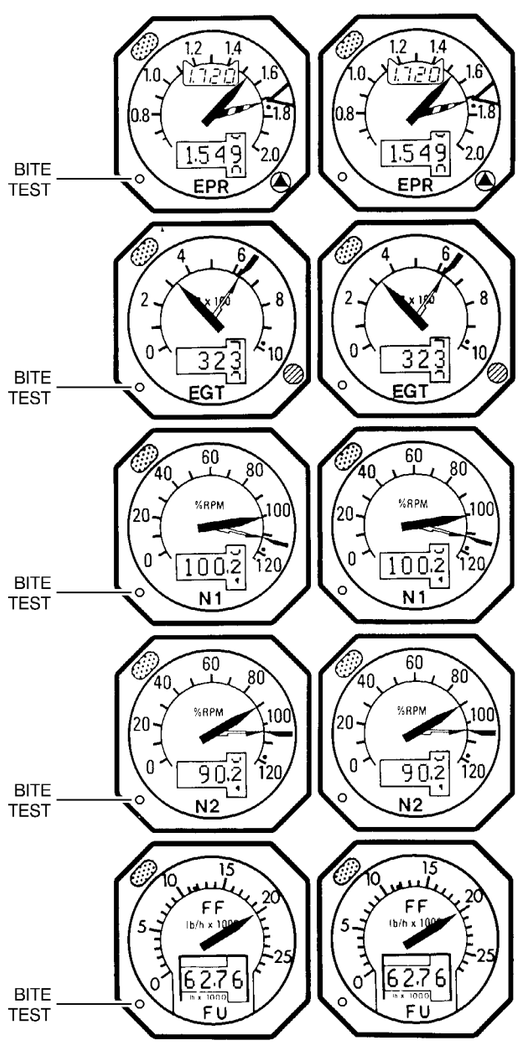

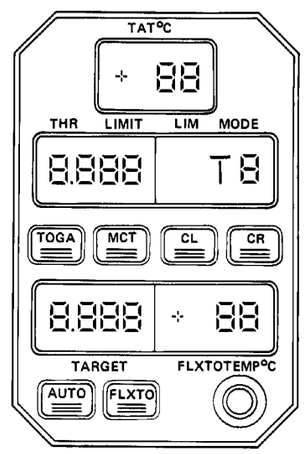

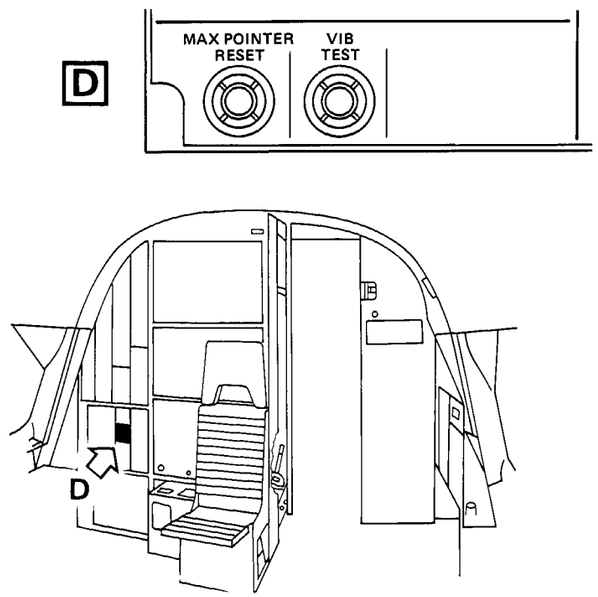

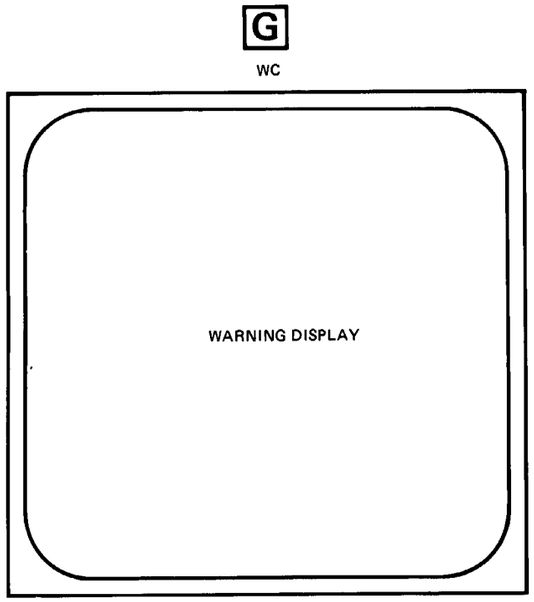

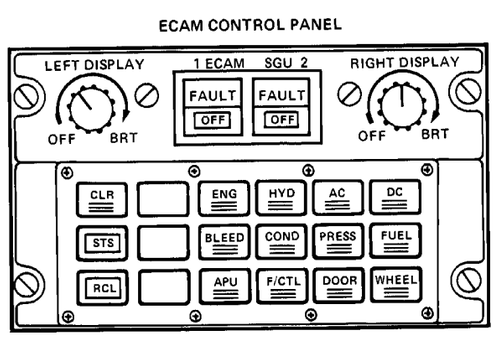

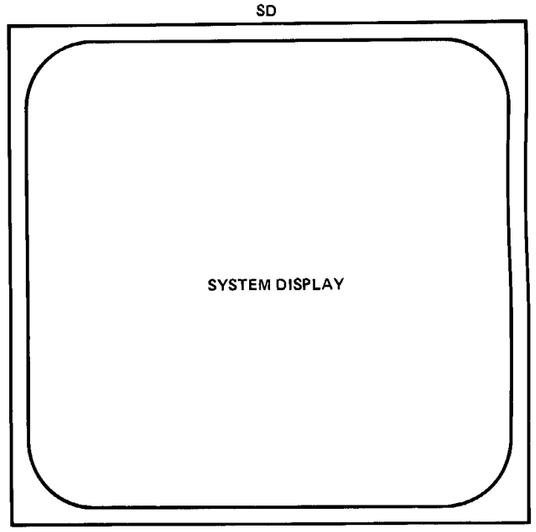

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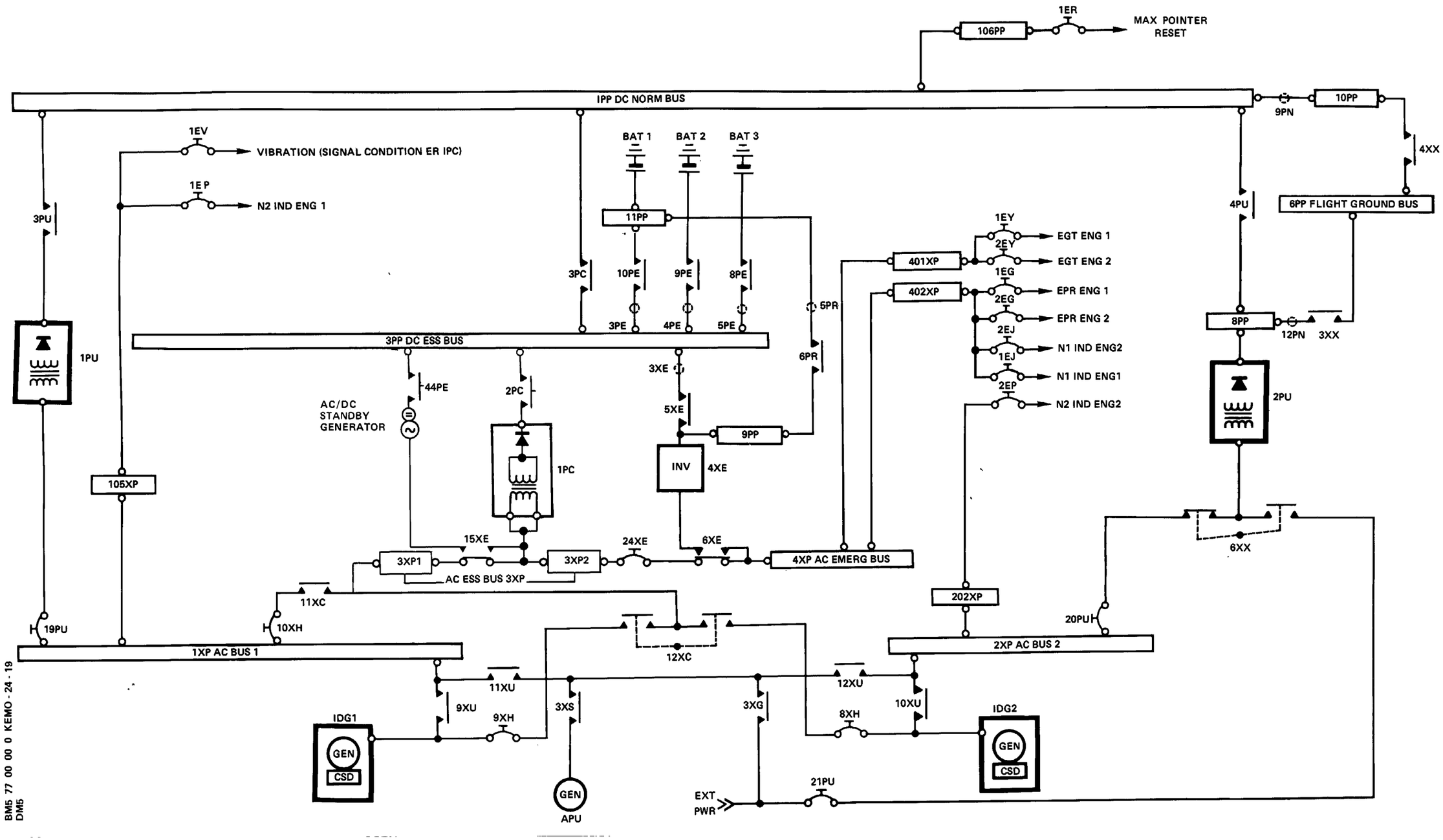
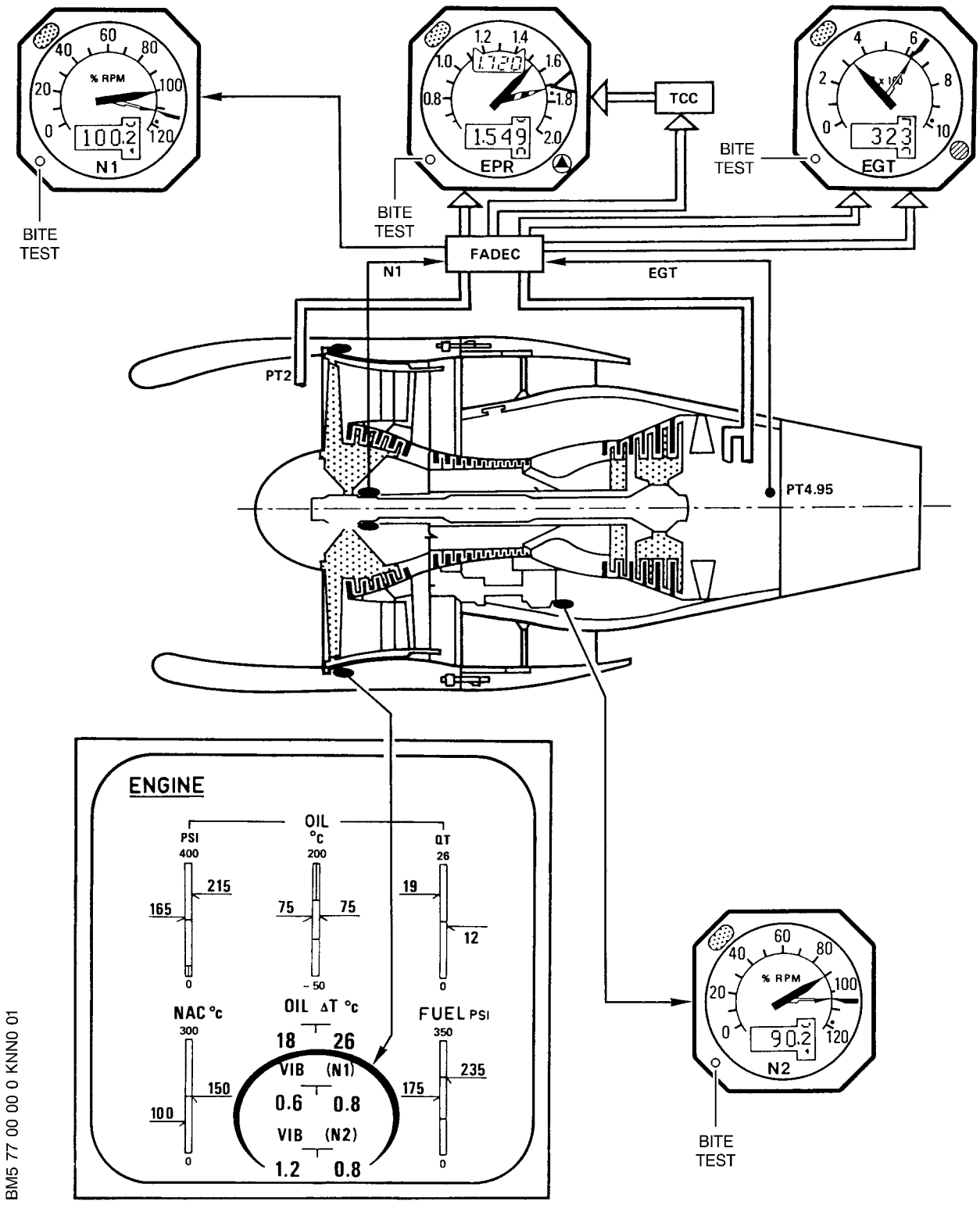
Control and Monitoring - Component Location
Figure 001

R



ENG1/ENG2 Indicating System Electrical Supply
Figure 002



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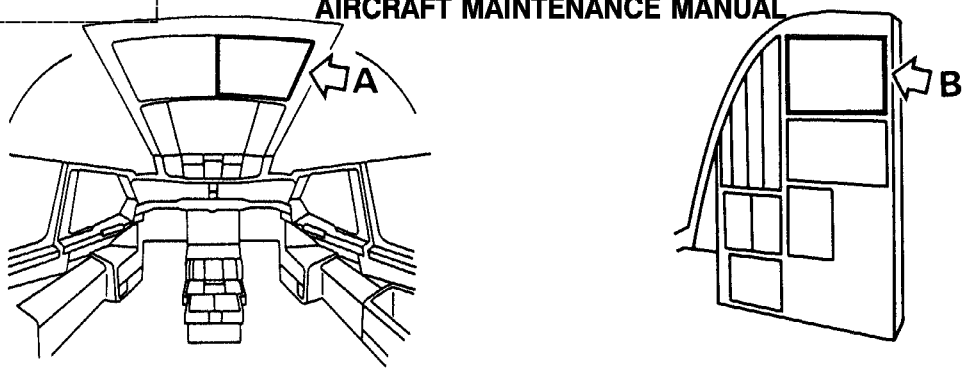
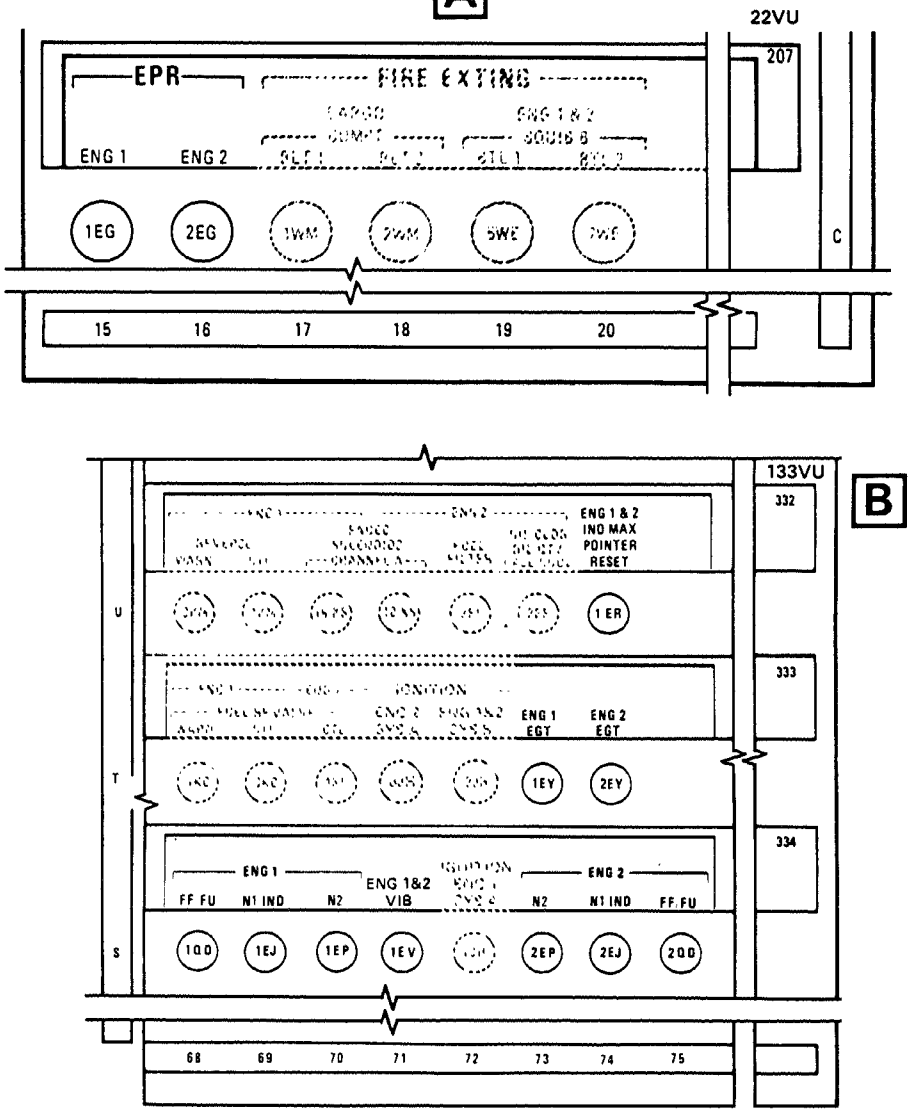
Engine Indicating
Figure 003

R





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Circuit Breakers - Component Location
Figure 004

2. Functions

(Ref. Fig. 005)
(Ref. Fig. 006)
(Ref. Fig. 007)
(Ref. Fig. 008)
(Ref. Fig. 009)
(Ref. Fig. 010)
(Ref. Fig. 011)

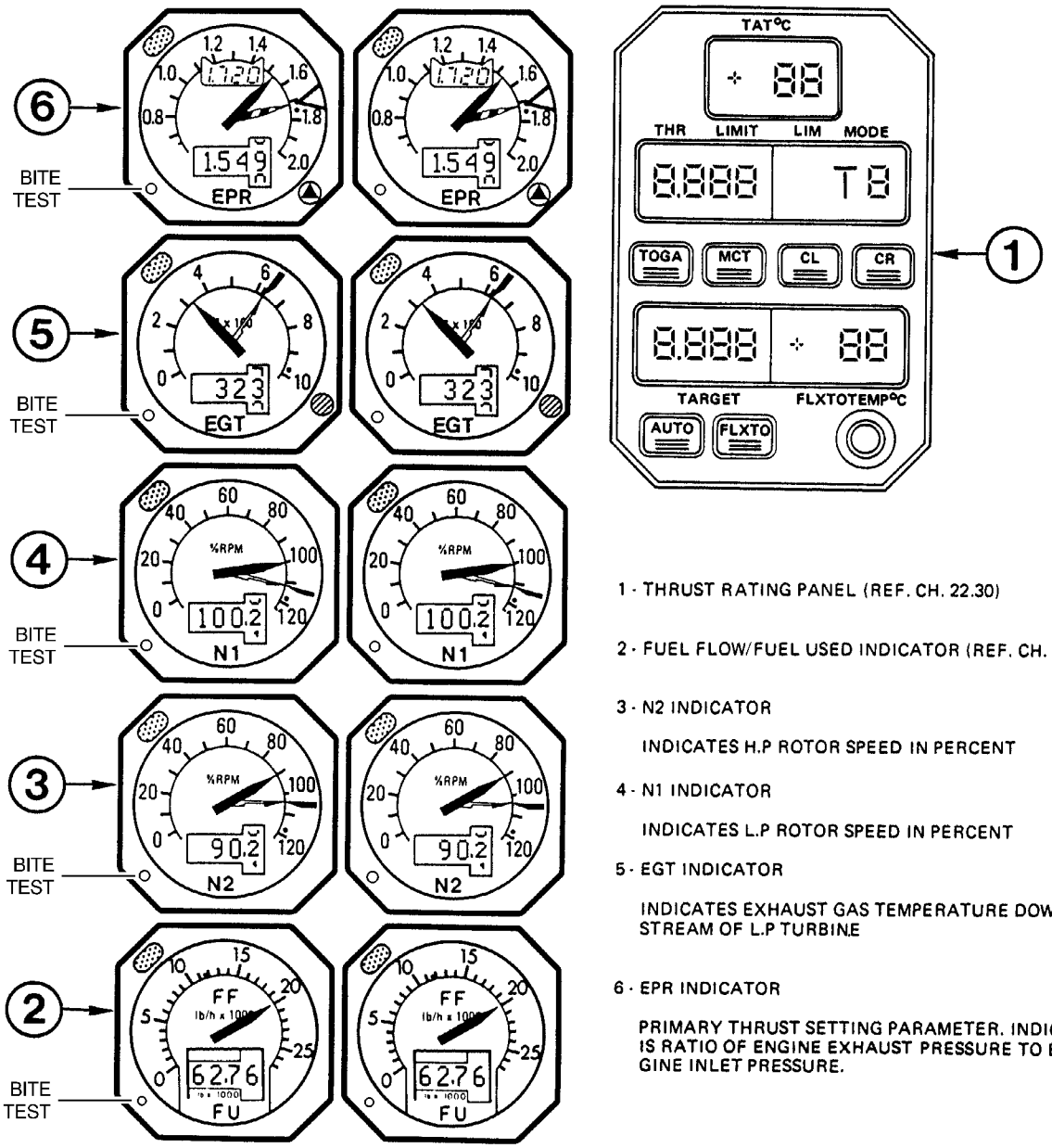
R **ON A/C 101-104,

R Post SB 72-2032 For A/C 101-104,

(Ref. Fig. 012)

**ON A/C 101-200,

(Ref. Fig. 013)
(Ref. Fig. 014)
(Ref. Fig. 015)
(Ref. Fig. 016)
(Ref. Fig. 017)
(Ref. Fig. 018)



1 - THRUST RATING PANEL (REF. CH. 22.30)

2 - FUEL FLOW/FUEL USED INDICATOR (REF. CH. 73.30)

3 - N2 INDICATOR

INDICATES H.P ROTOR SPEED IN PERCENT

4 - N1 INDICATOR

INDICATES L.P ROTOR SPEED IN PERCENT

5 - EGT INDICATOR

INDICATES EXHAUST GAS TEMPERATURE DOWN-STREAM OF L.P TURBINE

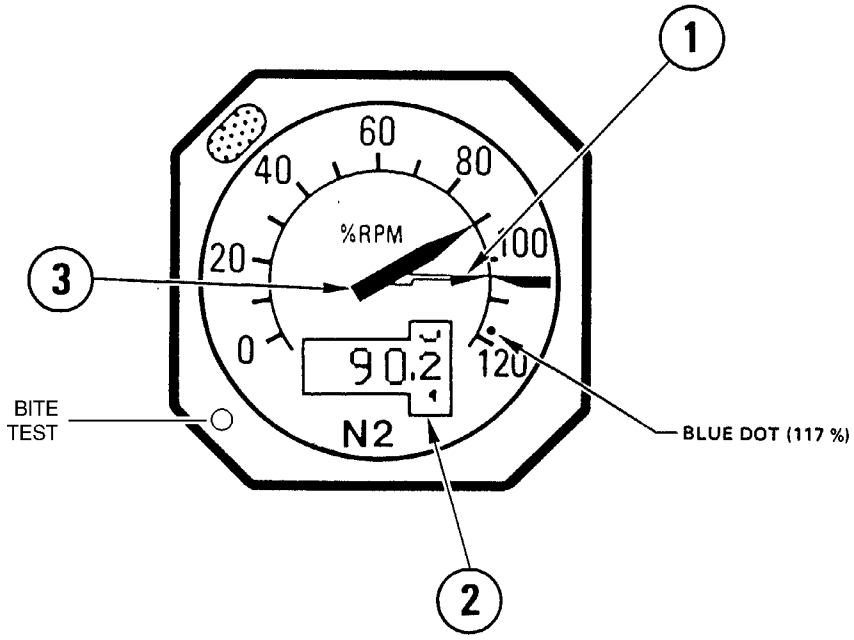
6 - EPR INDICATOR

PRIMARY THRUST SETTING PARAMETER. INDICATION IS RATIO OF ENGINE EXHAUST PRESSURE TO ENGINE INLET PRESSURE.

BM5 77 00 00 0 KRM0 01

Main Engine Parameters
Figure 005

R



1 - OVERSPEED POINTER

NORMALLY IN FRONT OF RED LINE
IN THE CASE OF AN OVERSPEED IT WILL INDICATE THE MAXIMUM VALUE OBTAINED
IT IS RESET BY PRESSING THE MAX POINTER RESET PUSH BUTTON

2 - DIGITAL COUNTER

INDICATES N2 SPEED IN DIGITAL FROM
IF THE INSTRUMENT IS NOT POWERED THE COUNTER IS BLACK
IN THE CASE OF A SIGNAL FAILURE, THE COUNTER DISPLAYS ----
DURING LIGHT TEST, THE COUNTER WILL SHOW 8888

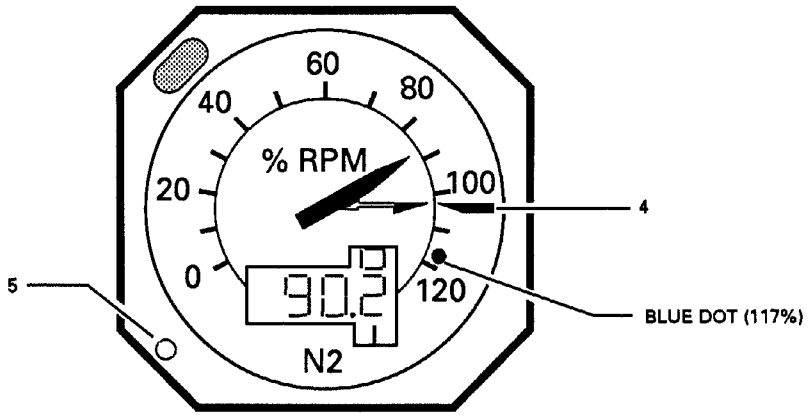
3 - POINTER

INDICATES N2 SPEED ON THE ANALOGUE SCALE
IF THE INSTRUMENT IS NOT POWERED OR IN THE CASE OF A SIGNAL FAILURE, THE POINTER SHOWS LOWEST VALUE (< 0).

BM5 77 00 00 0 KVM0 01

R

N2 RPM Indicator
Figure 006



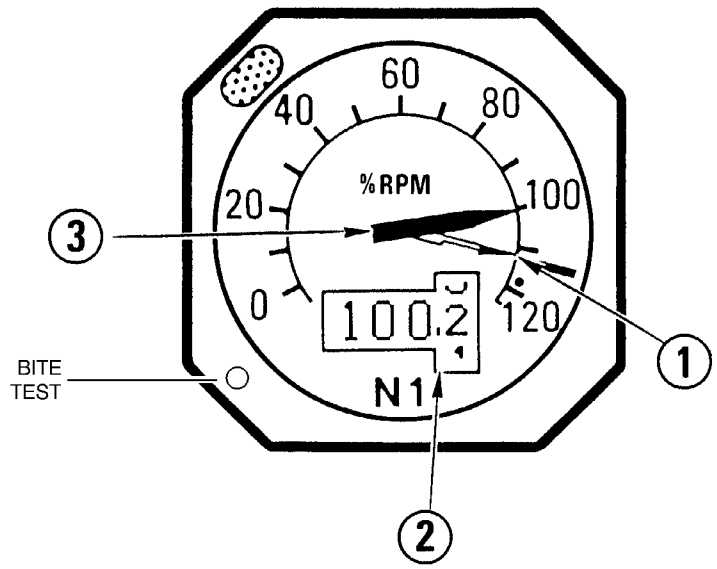
4 - RED LINE

INDICATES MAXIMUM PERMISSIBLE OPERATING SPEED
WHEN THE POINTER EXCEEDS THIS VALUE, AN INTERNAL SWITCH WILL CAUSE :
- THE ENG AMBER WARNING LIGHT ON MASTER CAUTION TO COME ON ACCOMPANIED BY THE SINGLE CHIME GONG
- THE ENGINE PAGE TO APPEAR ON THE RIGHT ECAM DISPLAY
- THE ASSOCIATED INFORMATION TO APPEAR ON THE LEFT ECAM DISPLAY

5 - BITE TEST

USED TO TEST INDICATOR OPERATION

WHEN PUSHED THE POINTER DIGITAL COUNTER AND THE OVERSPEED POINTER INDICATE 117% (BLUE DOT ON ANALOGUE SCALE) AND THE OVERSPEED WARNINGS (REF. RED LINE) OCCUR IF THE INDICATOR IS OPERATIONAL.



1- OVERSPEED POINTER

NORMALLY IN FRONT OF RED LINE.

IN THE CASE OF AN OVERSPEED, IT WILL INDICATE THE MAXIMUM VALUE OBTAINED.

IT IS RESET BY PRESSING THE MAX POINTER RESET PUSH BUTTON.

2- DIGITAL COUNTER

INDICATES N1 SPEED IN DIGITAL FORM

IF INDICATION IS NOT POWERED, THE COUNTER IS BLACK

IN THE CASE OF A SIGNAL FAILURE, THE COUNTER DISPLAYS - - - -

DURING LIGHT TEST, THE COUNTER WILL SHOW 8888

3- POINTER

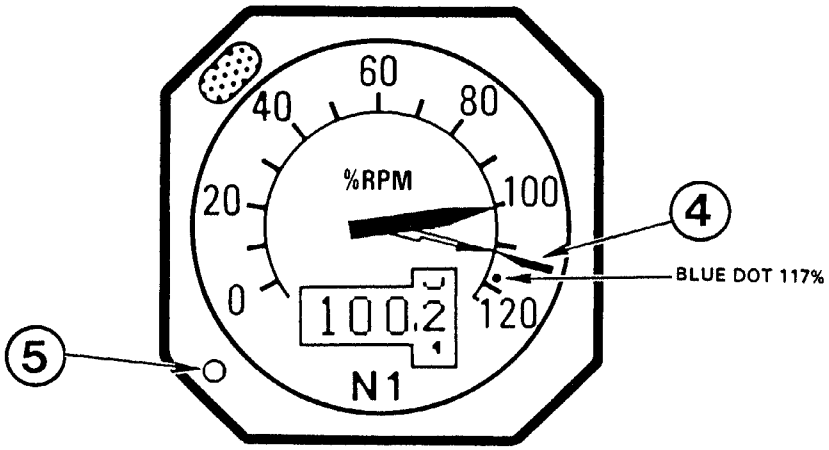
INDICATES N1 SPEED ON THE ANALOG SCALE (0-120%)

IF THE INSTRUMENT IS NOT POWERED, OR IN THE CASE OF A SIGNAL FAILURE THE POINTER SHOWS THE LOWEST VALUE (<0).

BM5 77 00 00 0 KDN0 01

N1 RPM Indicator
Figure 008

R



4 - RED LINE

INDICATES MAXIMUM PERMISSIBLE OPERATING SPEED (111,4%)

WHEN THE POINTER EXCEEDS THIS VALUE. AN INTERNAL SWITCH WILL CAUSE:

THE ENG AMBER WARNING LIGHT ON MASTER CAUTION TO COME ON ACCOMPANIED BY THE SINGLE CHIME GONG

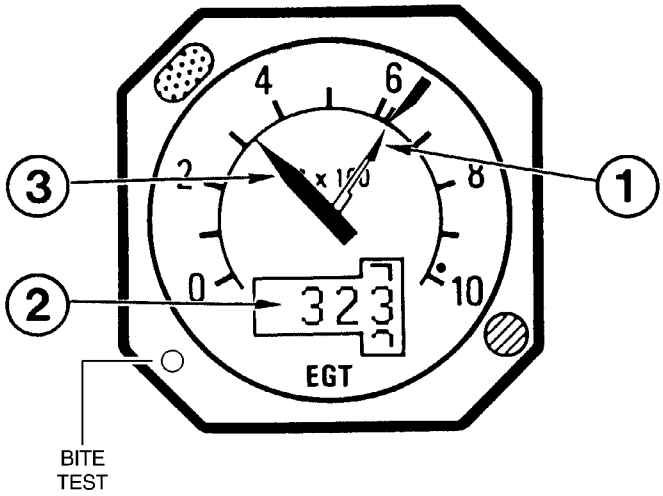
- THE ENGINE PAGE TO APPEAR ON THE RIGHT ECAM DISPLAY

THE ASSOCIATED INFORMATION TO APPEAR ON THE LEFT ECAM DISPLAY

5 - BITE TEST

USED TO TEST INDICATOR OPERATION

WHEN PUSHED POINTER, DIGITAL COUNTER AND OVERSPEED POINTER INDICATE 117% (BLUE DOT ON ANALOGUE SCALE) AND THE OVERSPEED WARNINGS (REF . RED LINE) OCCUR IF THE INDICATOR IS OPERATIONAL.



1 · OVERTEMPERATURE POINTER

NORMALLY IN FRONT OF RED LINE. IN THE CASE OF AN OVERTEMPERATURE, IT WILL INDICATE THE MAXIMUM EGT OBTAINED.

IT IS RESET BY PRESSING THE MAX. POINTER RESET PUSH BUTTON.

2 · DIGITAL COUNTER

INDICATES THE EGT IN DIGITAL FORM

IF INDICATOR IS NOT POWERED, THE COUNTER IS BLACK

IN THE CASE OF A SIGNAL FAILURE, THE COUNTER DISPLAYS – – – –

DURING LIGHT TEST THE COUNTER WILL SHOW 8888

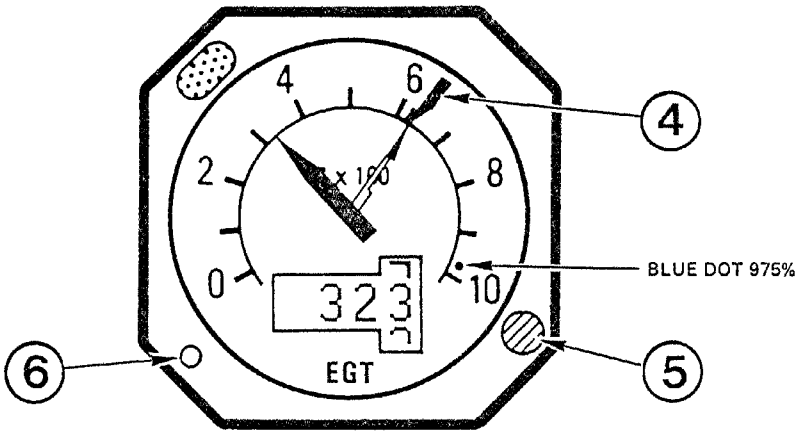
3 · POINTER

INDICATES EGT ON THE ANALOGUE SCALE (0 · 1000° C)
IF INSTRUMENT NOT POWERED, OR IN THE CASE OF A SIGNAL FAILURE THE NEEDLE SHOWS LOWEST VALUE (< 0)

BM5 77 00 00 0 KMN0 01

R

EGT Indicator
Figure 010



4 - RED LINE

INDICATES MAXIMUM PERMISSIBLE EGT OPERATING TEMPERATURE (+YELLOW BAND BETWEEN 600°C)

WHEN THE POINTER EXCEEDS THIS VALUE AN INTERNAL SWITCH WILL CAUSE:

- THE ENGINE AMBER WARNING LIGHT ON MASTER CAUTION TO COME ON ACCOMPANIED BY THE SINGLE CHIME GONG
- THE ENGINE PAGE TO APPEAR ON THE RIGHT ECAM DISPLAY
- THE ASSOCIATED INFORMATION TO APPEAR ON THE LEFT ECAM DISPLAY
- THE PEA LIGHT TO COME ON

5 - PEA LIGHT (AMBER)

COMES ON WHEN POINTER EXCEEDS RED LINE.

6 - BITE TEST

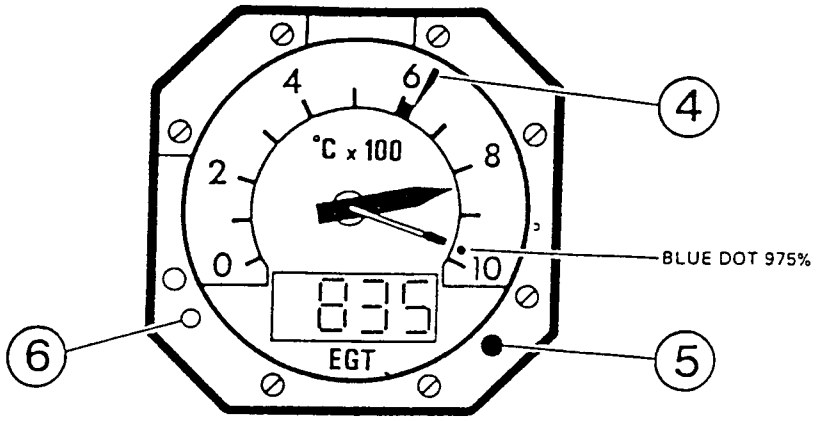
USED TO TEST INDICATOR OPERATION

WHEN PUSHED POINTER DIGITAL COUNTER AND OVERTEMPERATURE POINTER INDICATE 975°C (BLUE DOT ON ANALOGUE SCALE) AND OVERTEMPERATURE WARNINGS OCCUR (REF . RED LINE) IF INDICATOR IS OPERATIONAL

BM5 77 00 00 0 KSN0 02

R

EGT Indicator
Figure 011



4 - RED LINE

INDICATES MAXIMUM PERMISSIBLE EGT OPERATING TEMPERATURE (650°C) (+YELLOW BAND BETWEEN 625°C AND 650°C)

WHEN THE POINTER EXCEEDS THIS VALUE AN INTERNAL SWITCH WILL CAUSE:

THE ENGINE AMBER WARNING LIGHT ON MASTER CAUTION TO COME ON ACCOMPANIED BY THE SINGLE CHIME GONG

THE ENGINE PAGE TO APPEAR ON THE RIGHT ECAM DISPLAY

- THE ASSOCIATED INFORMATION TO APPEAR ON THE LEFT ECAM DISPLAY

THE PEA LIGHT TO COME ON

5 - PEA LIGHT (AMBER)

COMES ON WHEN POINTER EXCEEDS RED LINE.

6 - BITE TEST

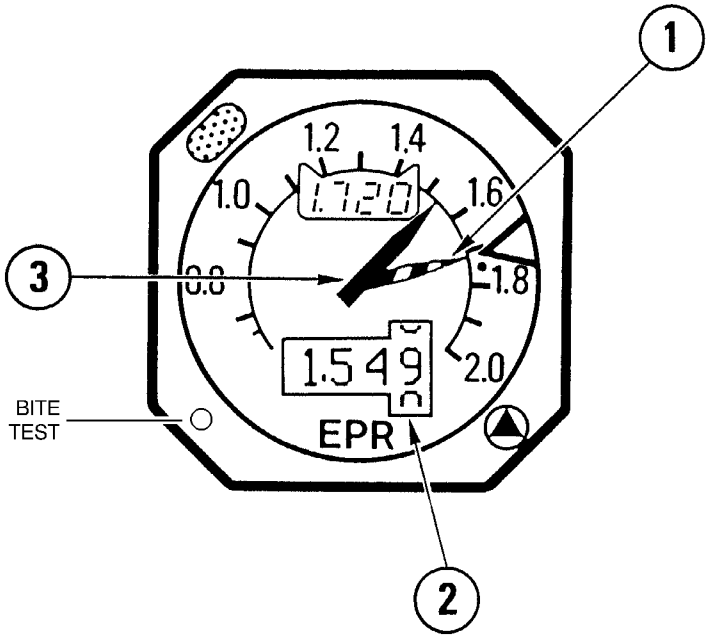
USED TO TEST INDICATOR OPERATION

WHEN PUSHED POINTER DIGITAL COUNTER AND OVERTEMPERATURE POINTER INDICATE 975°C (BLUE DOT ON ANALOGUE SCALE) AND OVERTEMPERATURE WARNINGS OCCUR (REF . RED LINE) IF INDICATOR IS OPERATIONAL

BM5 77 00 00 0 KSP0 02

R

EGT Indicator
Figure 012



1 - EPR COMMAND POINTER (BLACK AND WHITE)

DISPLAYS THE EPR CALCULATED BY THE FADEC ACCORDING TO THE THROLLE SETTING AND FLIGHT CONDITIONS. IN NORMAL STEADY STATE CONDITIONS COINCIDES WITH EPR ACTUAL POINTER.

IF INDICATOR IS NOT POWERED, TEH POINTER SHOWS LAST POSITION.

IN THE CASE OF THE COMMAND SIGNAL FAILURE, THE POINTER SHOWS LOWEST VALUE (0.65)

2 - EPR ACTUAL COUNTER

INDICATES ACTUAL ENGINE EPR CACULATED BY THE FADEC AND DISPLAYED IN DIGITAL FORM
IF INDICATOR IS NOT POWERED, THE COUTER IS BLACK

IN THE CASE OF A SIGNAL FAILURE. THE COUTER DISPLAYS ----

DURING LIGHT TEST THE COUTER WILL SHOW 8888

3 - EPR ACTUAL POINTER (WHITE)

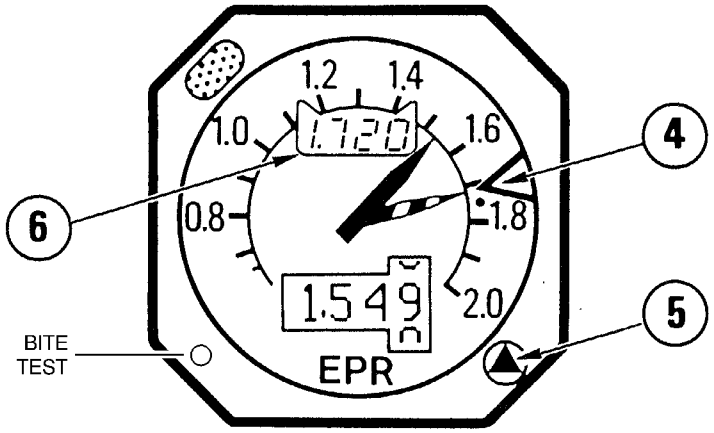
INDICATES ACTUAL ENGINE EPR CALCULATED BY THE FADEC AND DISPLAYED ON THE ANALOGUE SCALE (0.65-2.0)

IF THE INDICATOR IS NOT POWERED OR IN THE CASE OF A SIGNAL FAILURE, THE POINTER SHOWS LOWEST VALUE (0.65).

BM5 77 00 00 0 KWN0 01

EPR Indicator
Figure 013

R



4 - INDEX

INDICATES EPR LIMIT.

IN MANUAL MODE, SET BY ROTATING THE KNOB.

IN AUTOMATIC MODE, IT IS CONTROLLED BY THE TCC (REF. CH. 22.30), AND INDICATES EPR LIMIT AS A FUNCTION OF THE MODE SELECTED ON THE TRP, FLIGHT CONDITIONS AND AIR BLEED CONFIGURATION.

5 - KNOB

USED TO SELECTED MANUAL OR AUTOMATIC EPR LIMIT CALCULATION MODE.

PULLED OUT:

- MANUAL MODE SELECTED
- UPPER DIGITAL COUNTER APPEARS

CREW CALCULATES EPR LIMIT FROM CURVES IN THE FLIGHT MANUAL. ROTATING KNOB MOVES INDEX, AND UPPER DIGITAL COUNTER INDICATES CORRESPONDING VALUE, THUS ALLOWING DESIRED EPR LIMIT TO BE SELECTED.

PUSHED IN:

- AUTOMATIC MODE SELECTED
- UPPER DIGITAL COUNTER BLANKED

INDEX IS CONTROLLED BY THE TCC (REF. CH. 22.30).

6 - UPPER DIGITAL COUNTER

INDICATES EPR LIMIT (IN MANUAL MODE ONLY)

KNOB PULLED OUT:

- MANUAL MODE SELECTED

INDICATES IN DIGITAL FORM THE SETTING OF THR INDEX

KNOB PUSHED IN:

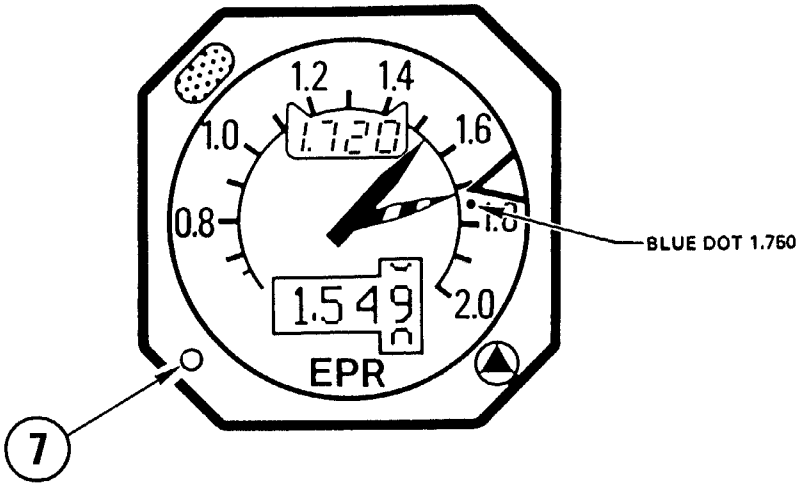
- AUTOMATIC MODE SELECTED

COUNTER COVERED BY MASK

BM5 77 00 00 0 KAN0 01

EPR Indicator
Figure 014

R



7 BITE TEST

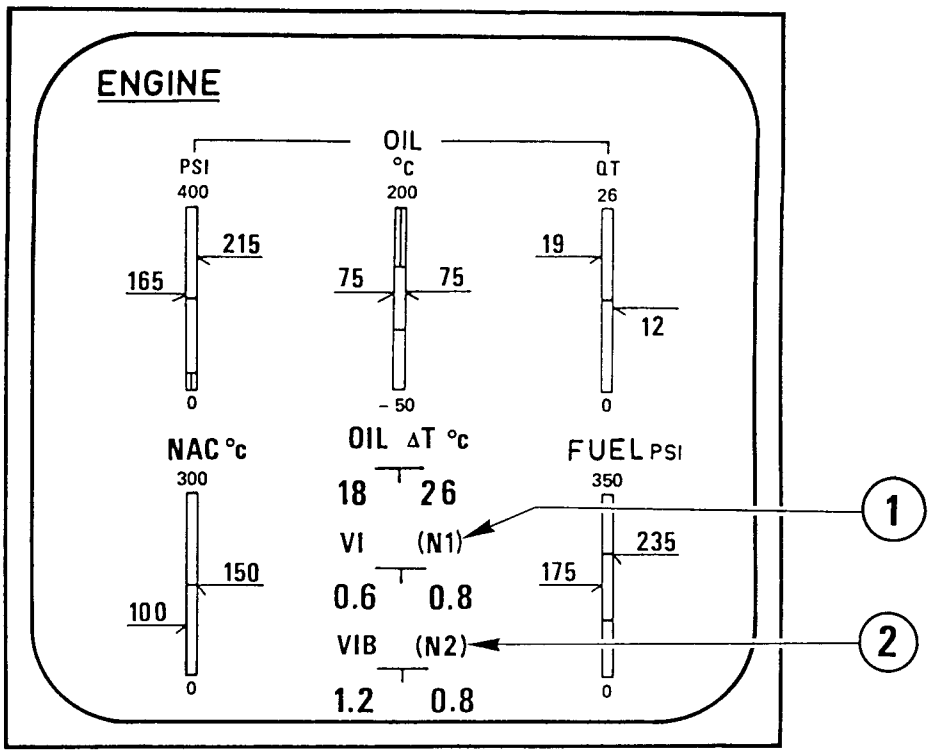
USED TO TEST INDICATOR OPERATION

WHEN PUSHED EPR ACTUAL POINTER, EPR ACTUAL COUNTER, EPR COMMAND POINTER, AND INDEX SHOW 1.750 (BLUE DOT ON THE ANALOGUE SCALE) IF THE INDICATOR IS OPERATIONAL

BM5 77 00 00 0 KEN0 01

EPR Indicator
Figure 015

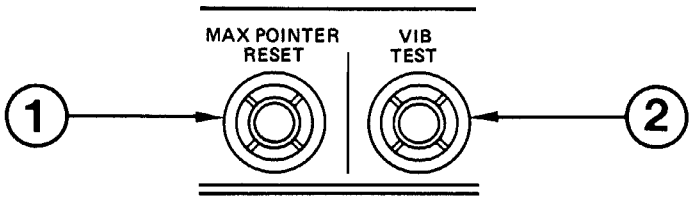
R



1. N1 VIBRATION LEVEL ENGINE 1/ENGINE 2 (GREEN)
   VIBRATION SCALE IS FROM 0 TO 10 UNITS (0 - 6 in./sec).
   IF VIBRATION LEVEL EXCEEDS 3 UNITS, INDICATION FLASHES.
2. N2 VIBRATION LEVEL ENGINE 1/ENGINE 2 (GREEN)
   VIBRATION SCALE IS FROM 0 TO 10 UNITS (0 - 6 in./sec)
   IF VIBRATION LEVEL EXCEEDS 5 UNITS INDICATION FLASHES.

BM5 77 00 00 0 KGNO - 01

Engine Vibration Indication
Figure 016



1 - MAX POINTER RESET PUSH BUTTON,LOCATED ON MAINTENANCE PANEL

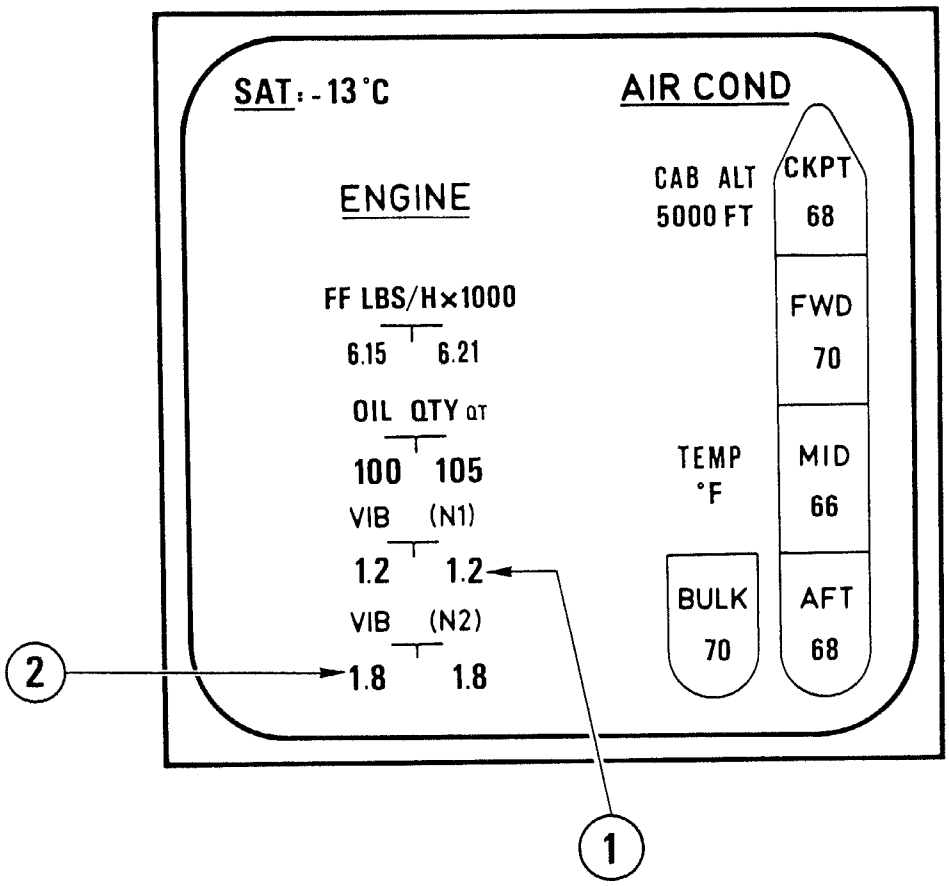
WHEN PRESSED, RESETS SIMULTANEOUSLY ALL THE OVERTEMPERATURE AND OVERSPEED POINTERS IN FRONT OF THE RED LINES.

2 - VIB TEST PUSH BUTTON,LOCATED ON MAINTENANCE PANEL

USED TO TEST VIBRATION MONITORING SYSTEM WHEN PRESSED.

BM5 77 00 00 0 KJNO - 19

Max Point Reset - Vib Test
Figure 017



1. N1 VIBRATION LEVEL ENGINE 1/ENGINE 2 (GREEN)
   VIBRATION SCALE IS FROM 0 TO 10 UNITS (0 - 6 in./sec).
   IF VIBRATION LEVEL EXEEDS 3 UNITS, INDICATION FLASHES.
2. N2 VIBRATION LEVEL ENGINE 1/ENGINE 2 (GREEN)
   VIBRATION SCALE IS FROM O TO 10 UNITS (0 - 6 in./sec)
   IF VIBRATION LEVEL EXCEEDS 5 UNITS INDICATION FLASHES.

BM5 77 00 00 0 KLUO-26-21
DM5

Engine Vibration Indication
Figure 018

1. Specific Fits and Clearances

A. General

(1) Reference numbers on figures indicate location of parts for which fits and clearances are specified. Description of, and limits for, these fits and clearances are located in tables of corresponding reference numbers.

(2) Unless otherwise specified, all fits are diametral except spline fits, which are calculated for chordal dimensions, and blade tip clearance, which is radial.

(3) Numbers in all columns shall be interpreted in in. and (millimeters).

(4) Letter "T" following limits indicates tight fit.

(5) Description column provides nomenclature for part or part concerned.

B. Inspection Frequency Requirements

(1) IFR column provides Inspection Frequency Requirements.
Letter Codes A, B or C located in IFR column indicate manner and frequency of inspection recommended for item identified by adjacent reference number, as applicable to normal or routine repair.

IFR CODE	DEFINITION
A	Clearance or fit must be calculated from part measurements at each installation of parts. Part measurements taken and recorded at time of individual part inspection are considered equally as valid as measurements taken at time of part installation.
B	Clearance or fit must be estimated at each installation of parts. Use trial assembly or similar means to estimate clearance or fit. Measurement of parts and calculation of actual fit or clearance is required only if : - estimating procedure indicates that clearance or fit is outside specified tolerance, or - either or both mating parts involved have been replaced or repaired in an area or way which would affect the clearance or fit.
C	Fit not subject to change in normal engine operation. Measurement of parts and calculation of fit is required only if either of mating parts involved has been replaced or repaired in an area or way which would affect fit.

C. New Part Reference Dimensions

(1) Dimensions are provided in this column for reference only.

(2) Dimensions are the minimum and maximum manufacturing values in inches (and millimeters) for each part listed in the description column.

D. Limits

(1)Limits applicable to any combination of new or used parts.

(a)This column provides the acceptable (minimum-maximum) range of fit or clearance in inches (and millimeters). These limits may be applied to any combination of new or used parts.

(b)The limits are based on the mathematical combination of the minimum and maximum values specified in the New Part Reference Dimensions column. See Example 1.

(c)Limits which have been expanded to be less restrictive than new part conditions are identified with an asterisk (*) adjacent to the value. See Example 2.

EXAMPLE 1

Ref. No.	I F R	Description	New Part Reference Dimensions Min	-	Max	Limits Min	Limits Max
1812		Bearing ---	0.508 (12.903)		0.512 (13.005)		
		Support ---	0.517 (13.131)		0.527 (13.385)	0.005 (0.126)	0.019 (0.482)

NOTE : In Example 1 limits are determined by comparing bearing and support referenced dimensions as follows :

0.517	(-)	0.512	=	.005
(13.131)		(13.005)		(0.126)
.527	(-)	.508	=	.019
(13.385)		(12.903)		(0.482)

EXAMPLE 2

Ref. No.	I F R	Description	New Part Reference Dimensions Min	-	Max	Limits Min	Limits Max
1812		Bearing ---	0.508 (12.903)		0.512 (13.005)		
		Support ---	0.517 (13.131)		0.527 (13.385)	0.005 (0.126)	0.020* (0.508)*

NOTE : In Example 2 limits represent less restrictive values as indicated by the asterisk (*).

(2)Limits for selective application to engines scheduled for partial refurbishment.

(a)A second set of limits enclosed by brackets and lines may be provided. See Example 3. These enclosed limits are less restrictive and are intended to be selectively applied to engines scheduled for partial refurbishment.

EXAMPLE 3

Ref. No.	I F R	Description	New Part Reference Dimensions Min	-	Max	Limits Min - Max	
1812		Bearing ---	0.508 (12.903)		0.512 (13.005)		
		Support ---	0.517 (13.131)		0.527 (13.385)	0.005 (0.126)	0.019 (0.482)
					.005 (0.13)		.022 (0.56)

NOTE : In Example 3 the enclosed (less restrictive) limits are intended for selective application, see text.

E. Fits and Clearances

Ref. No.	I F R	Description	New Part Reference Dimensions Min	-	Max	Limits Min - Max
2163		Terminal Box Nut (Alumel) (Ref.77-21-02, P. Block 401) and (Ref. 77-21-03,P. Block 401).				
2164		Terminal Box Nut (chromel) (Ref.77-21-02, P.Block 401) and (Ref. 77-21-03, P. Block 401).				

N1 RPM INDICATING SYSTEM - DESCRIPTION AND OPERATION

1. Description

(Ref. Fig. 001)

The low pressure rotor speed is sensed by an engine mounted dual element sensor which sends a signal through the **FADEC** (channel **B**), proportional to the speed, to the **N1** indicator located on the main instrument panel. This indication is used as a back up for the **EPR** system. It is also used by the vibration system to set the tracking filter frequency.

Each channel of the **FADEC** uses one of the elements. The **FADEC** channel **B** uses its input for two functions. The first is to provide an **N1** signal within the processor for various control laws. The second function is to provide an input to a signal conditioning (buffer) circuit. This circuit provides its output to the flight compartment indicator.

A. N1 Tachometer Transmitter (Ref. Fig. 002)

The **N1** tachometer transmitter is mounted on the intermediate fan case at 5 o'clock and generates a magnetic field. Each one of the 60 teeth passing in front of this sensor causes an abrupt change in the magnetic field.

The sensor installation fulfills two requirements :

- obtain a strong signal, i.e. have a minimum distance between the sensor and the sense gear
- avoid any tip-rub.

This sensor generates an oscillation signal whose frequency is proportional to speed (100% **N1** = 3600 rpm = 3600 Hz, 1Hz = 1 rpm).

B. N1 RPM Indicator (Ref. Fig. 004)

(Ref. Fig. 003)

(1)Description

The **N1 RPM** indicator is located on the main instrument panel. It receives the **N1** tachometer transmitter signal from the channel **B** of the **FADEC** and processes it to display **N1** value in both analog (pointer) and digital (counter) formats. The digits are of the LCD type. The last digit indicate 0.1%, however, the overall channel accuracy, in normal operating conditions, is ± 0.2%. This indicator is supplied with 400 Hz/115 V by a normal busbar. Total range is from 0 to 125% rpm.

The max. pointer and overspeed warning are set to **N1** = 111.4% .

When this speed is reached, the single chime is activated and the engine alarm message displayed on the **ECAM** display unit as well as the **MASTER CAUTION** light comes on.

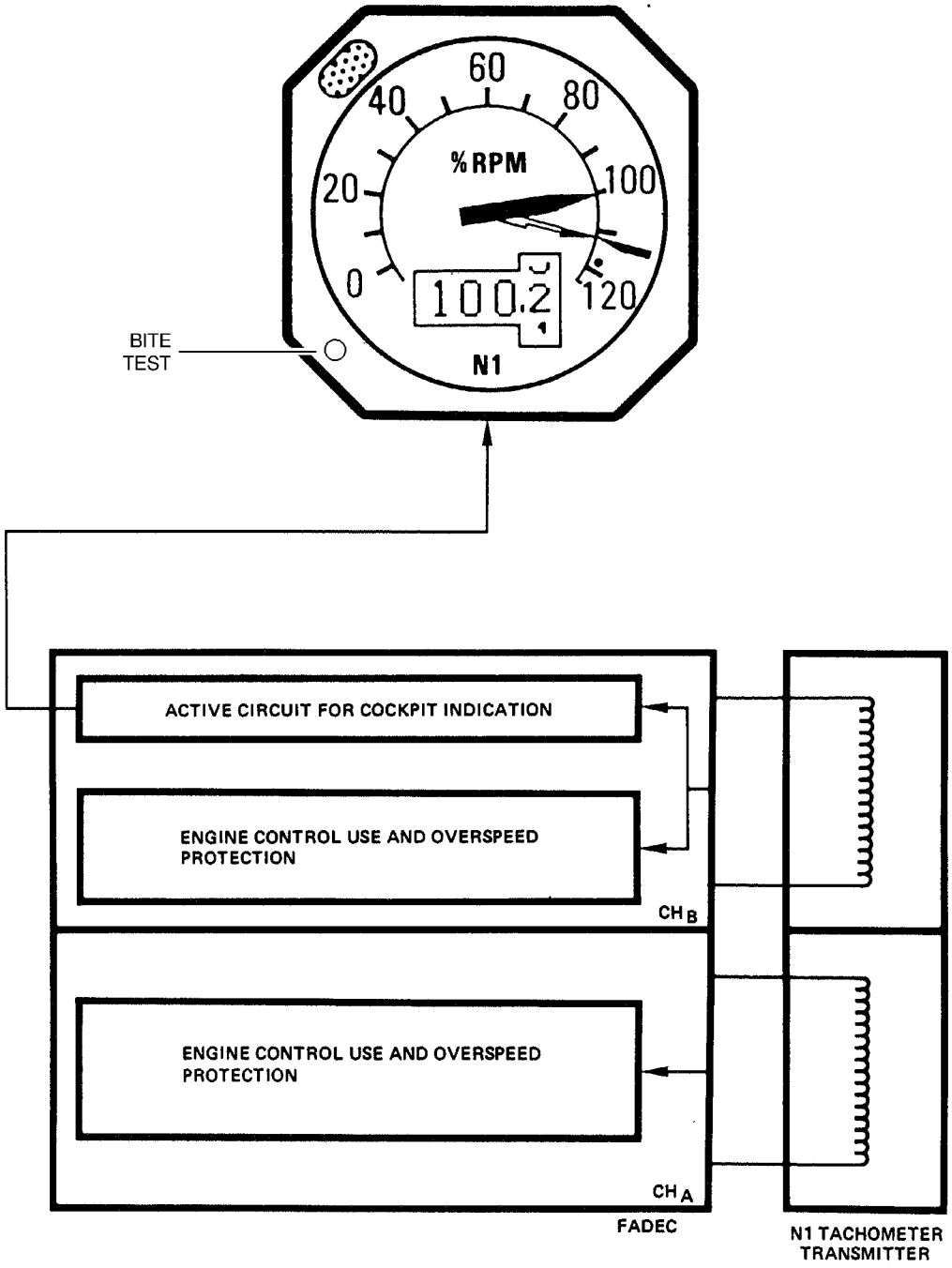
A MAX POINTER RESET signal can be activated from the flight compartment (Ref. 77-14-00, P. Block 1)

(2)Indicator test

R (a)**A BITE** test is provided in the lower left corner of the indicator. When the indicator is operating normally and **BITE** is selected by

R turning and maintaining the **BITE** test :

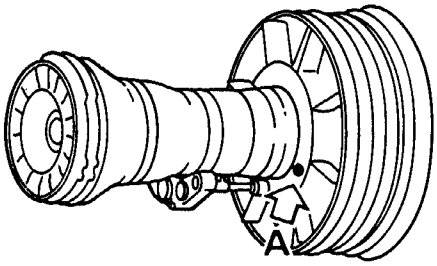
- the **LED** matrix sequentially indicates **ROM**, µP, **ULA** and then indicates the numeric value of the "blue dot" mark (117 % **N1** +/-1%)
- the **N1** pointer and **OVERSPEED** pointer go to the "blue dot" mark on the dial

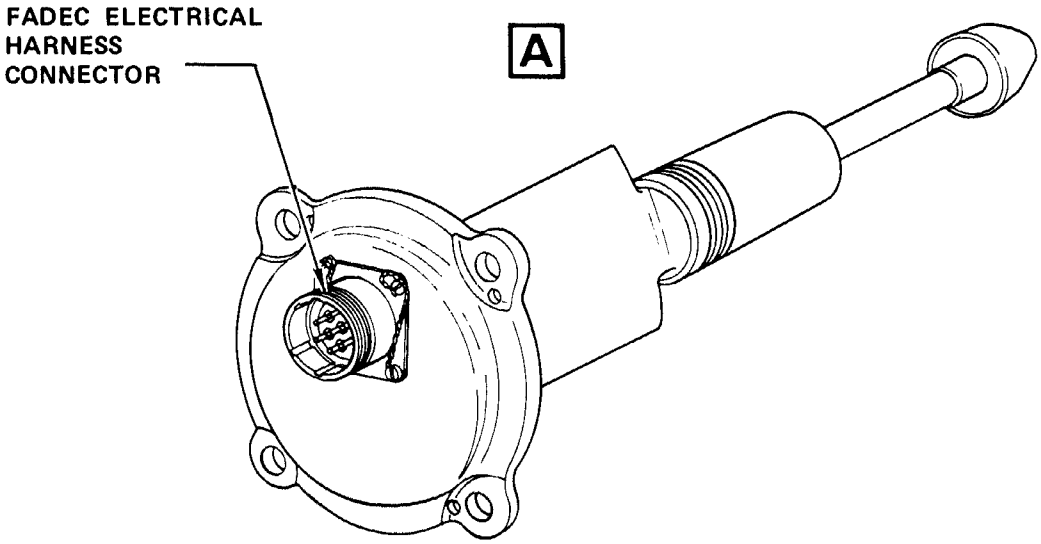


BM5 77 11 00 0 KEM0 01

N1 Indication
Figure 001

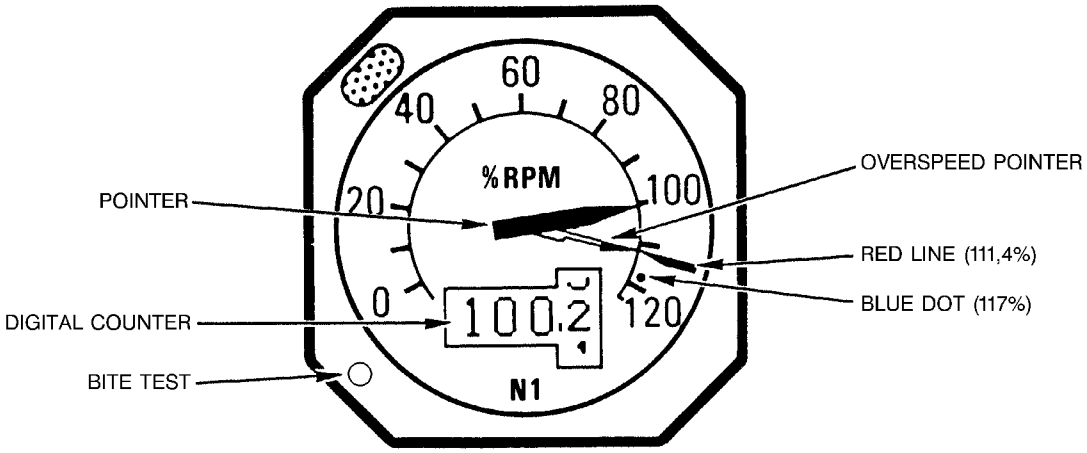
R





BM5 77 11 00 0 KAMO - 19

N1 Tachometer Tramsitter Indicator
Figure 002



100% 3600 RPM

BM5 77 11 00 0 KJM0 01

R

N1 RPM Indicator
Figure 003

- a message appears on the left **ECAM DU** associated with a **MASTER CAUTION** and **SINGLE CHIME**
- the **ENGINE** system page appears on the right **ECAM DU.**

R When the **BITE** test is released, the indicator returns to normal operation and warnings disappear.

NOTE : The **OVERSPEED** pointer on the indicator will return to the red line value (111,4 %) by pushing the **MAX POINTER RESET** pushbutton switch on panel **472VU.**

(b) In case of failure (loss of signal or wrong signal, internal failure of the indicator) only the center element of each digit appears on the counter (----).
In case of power supply loss, the counter is black.

(c) On receipt of a ground signal from the light test pushbutton switch, (0.5 s minimum duration), all digits are black for less than one second, then, all digits display 8 for less than 1 second, then if the test-signal is not there anymore, each digit returns to pretest value. If the test signal is still activated, a second test sequence starts.

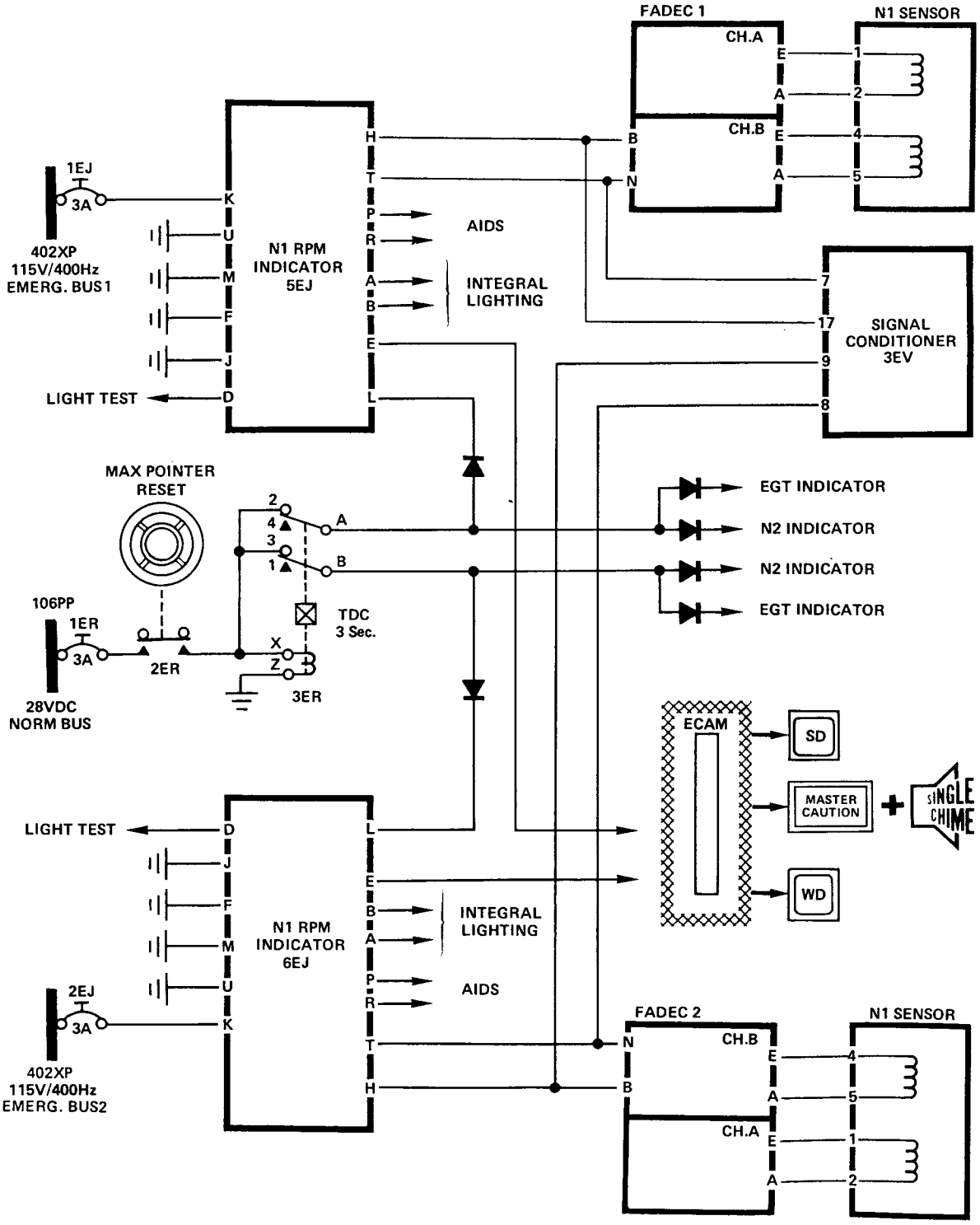
C. Operational Usage

This indicator is used as a backup of **EPR** for thrust setting. During engine start, **N1 RPM** indicator is used to monitor and detect low pressure rotor rotation.
In case of an overspeed alarm, the crew shall reduce the speed. If **N1** exceeds 111.4%, the engine shall be shutdown or landing should be made as soon as possible using minimum thrust required to sustain safe flight. In all cases, the crew must report the maximum speed and duration of the overspeed for corrective action.

2. Component Location

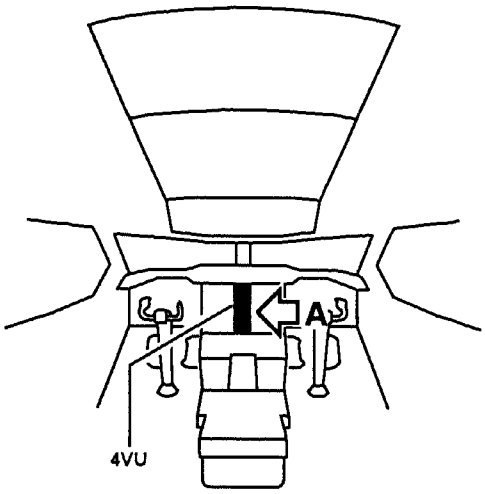
(Ref. Fig. 005)

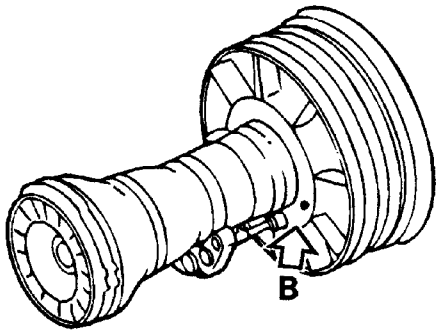
FIN	FUNCTIONAL DESIGNATION	PANEL	ZONE	ACCESS DOOR	ATA REF.
	TACHOMETER TRANSMITTER-N1		436	436 AR	77-11-01
	TACHOMETER TRANSMITTER-N1		446	446 AR	77-11-01
5EJ	INDICATOR-N1 RPM	4VU	211		77-11-12
6EJ	INDICATOR-N1 RPM	4VU	212		77-11-12



BM5 77 11 00 0 KLMO - 01

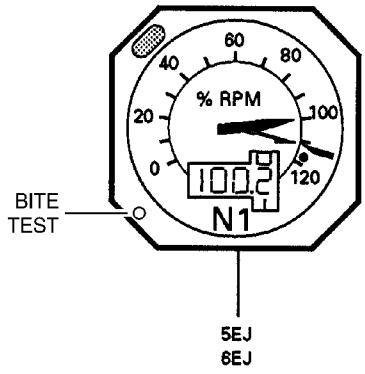
N1 Indication Electrical Circuit
Figure 004



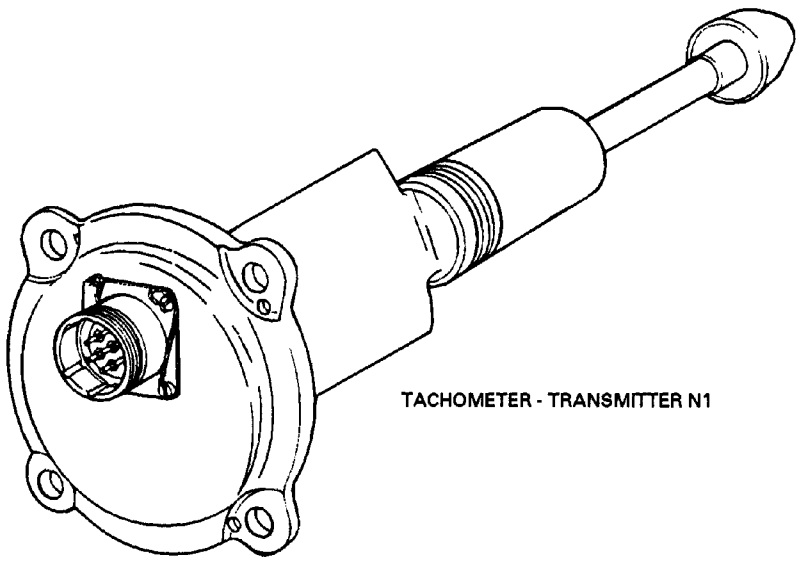


A

INDICATOR - N1 RPM



B



TACHOMETER - TRANSMITTER N1

BM5 77 11 00 0 KBM0 01

N1 RPM Indicating System - Component Location
Figure 005

R

TACHOMETER TRANSMITTER (N1) - REMOVAL/INSTALLATION

1. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Access Platform
C.	Key Washer
D.	Protective Closures
E.	Packings
F.	Torque Wrench
G.	Jackscrews (0.190-32) (Post SB PW4ENG 73-88)
H. PWA101359	Puller, Mechanical (Pre SB PW4ENG 73-88)
J. Material No.P03-001	Oils (Ref. 70-00-00)
K. Material No.P06-002	Lubricants (Ref. 70-00-00)
L. Material No.P06-015	Lubricants (Ref. 70-00-00)
Referenced Procedures	
- 70-00-00, P. Block 201	Standard Practices
- 71-13-00, P. Block 301	Cowls Doors
- 71-00-00, P. Block 501	Power Plant - General
- 72-23-05, P. Block 401	Fan Exit Liner Segments

2. Procedure

A. Job Set-Up

(1)Open, safety and tag the following circuit breakers :

PANEL	SERVICE	IDENT.	LOCATION
133VU	ENGINES/ENG2/REVERSE/CTL	2KM	331/V74
133VU	ENGINES/ENG1/REVERSE/CTL	1KM	332/U69
133VU	ENGINES/ENG2/IGNITION/SYS A	8JH	333/T71
133VU	ENGINES/ENG1 & 2/IGNITION/SYS B	2JH	333/T72
133VU	ENGINES/ENG1/IGNITION/SYS A	1JH	334/S72
133VU	ENGINES/ENG1 & 2/START/CTL & WARN	1KG	335/R68
132VU	ANTI-ICE/PROBES/CAPT/L STAT	4DA	322/N68
132VU	ANTI-ICE/PROBES/F/O/L STAT	8DA	323/M66

(2)Open fan cowl doors (Ref. 71-13-00, P. Block 301).

(3)Install access platform.

(4)Remove the fan exit liner segment (inner rear) that is at 5 o'clock (Ref. 72-23-05, P. Block 401).

B. Removal (Ref. Fig. 401)

(1)Disconnect W4P19 harness connector from transmitter.

(2)If equipped, bend tabs of keywashers down. Evenly loosen and remove the bolts and nuts (if equipped with locating stud post SB PW4ENG 73-88) that attach the transmitter. Discard the keywasher, if used. Remove the No. 1 bearing vibration transmitter cable bracket from the transmitter flange (if equipped).

CAUTION : DO NOT ATTEMPT TO ROTATE TRANSMITTER UNTIL DISENGAGED FROM INNER BRACKET.

Pre SB PW4ENG 73-88

(3)Use PWA 101359 Puller to break the interface betwen the flange of the transmitter probe and the intermediate case.

END Pre SB PW4ENG 73-88

Post SB PW4ENG 73-88

(4)Use three .190-32 jackscrews in the transmitter flange jackscrew holes to break the interface between the flange of the transmitter probe and the intermediate case.

END SB PW4ENG 73-88

(5)Remove the speed transmitter from the case.

(6)Remove and discard three packings from transmitter.

(7)Install protective closures.

C. Installation (Ref. Fig. 401)

(1)Remove protectives closures.

(2)Examine and adjust, if necessary, the gap between the end of the transmitter and the rotor as follows :

(a)Apply Material No.P06-015, approximately 0.070 in. (1.778 mm) thick, to flat surface on small end of transmitter.

(b)Install Class 1 shim in machined recess on lower shoulder of transmitter.

NOTE : Do not install the three packings to the transmitter at this time.

CAUTION : INSTALL TRANSMITTER WITH ELECTRICAL CONNECTOR REARWARD. DO NOT ROTATE TRANSMITTER DURING INSTALLATION OR DAMAGE TO TRANSMITTER OR ENGINE MAY RESULT.

(c)Carefully install spring - loaded speed transmitter into opening in intermediate case at approximately 5 o'clock position with electrical connector rearward.

(d)Lubricate the bolts and nuts (if equipped with the locating stud, post SB PW4ENG 73-88) with Material No.P03-001.
Temporarily install the washers, bolts and nuts (if equipped). Tighten evenly and engage the transmitter to the case completely. TORQUE the bolts and nuts (if equipped) to 85 lbf.in. (0.96 m.daN).
Make sure you engage the transmitter to the case completely.

(e)Slowly rotate fan rotor approximately 15 degrees counterclockwise as viewed from front of engine.

(f)Loosen bolts (and nut if equipped) and remove transmitter from engine.

(g)Carefully cut a section of wax away from end of transmitter and measure thickness of wax remaining in area of deepest impression. If result is between 0.020 - 0.050 in. (0.508 - 1.270 mm), proper shim is installed.

(h)If result is smaller than 0.020 in. (0.508 mm), replace Class 1 shim with a Class 2 shim.

(i)If result is greater than 0.050 in. (1.270 mm), remove Class 1 shim.

(j)Remove all wax from end of transmitter.

(3)Install two new packings, lubricated with Material No.P03-001, to the grooves in the shaft of the transmitter. Install one new packing, lubricated with Material No.P06-002, to the groove in the transmitter flange. Make sure the correct shim (if required) is installed on the

transmitter.

CAUTION : INSTALL TRANSMITTER WITH ELECTRICAL CONNECTOR REARWARD. DO NOT ROTATE TRANSMITTER DURING INSTALLATION OR DAMAGE TO TRANSMITTER OR ENGINE MAY RESULT.

(4)Carefully reinstall transmitter in intermediate case with electrical connector rearward.

(5)For engines with the No. 1 bearing vibration transmitter cable bracket, install the bracket to the forward two holes. Attach the transmitter as follows (Ref. Fig. 401) (Sheet 2).

CAUTION : YOU MUST USE KEYWASHERS WITH CASES THAT DO NOT HAVE SELF-LOCKING INSERTS IN THE INTERMEDIATE CASE BOSS.

(a)Lubricate the bolts with Material No.P03-001.

(b)Install the bolts and washers (keywashers for engines without self-locking inserts) that attach the transmitter. Tighten evenly by hand.

NOTE : Use the longer bolts at the bracket location if equipped.

(c)For engines with the locating stud, install the keywashers and nut, lubricated with Material No.P03-001. Tighten by hand.

(d)TORQUE (as equipped)

- the bolts without the self-locking insert feature to between 65 and 85 lbf.in. (0.74 and 0.96 m.daN)
- the bolts with the self-locking insert feature to between 85 and 95 lbf.in. (0.96 and 1.07 m.daN)
- the nut on the locating stud to between 150 and 170 lbf.in. (1.69 and 1.92 m.daN).

(e)Bend the keywasher tabs if used.

(6)If equipped, install the clamps and bolts, lubricated with Material No.P03-001 and attach the No. 1 bearing vibration transmitter cable to the bracket. TORQUE the clamp bolt to between 36 and 40 lbf.in. (0.41 and 0.45 m.daN).

(7)Connect W4P19 harness connector to transmitter.

D. Close-Up and Test

(1)Install the fan exit liner segment (inner rear) that you removed (Ref. 72-23-05, P. Block 401).

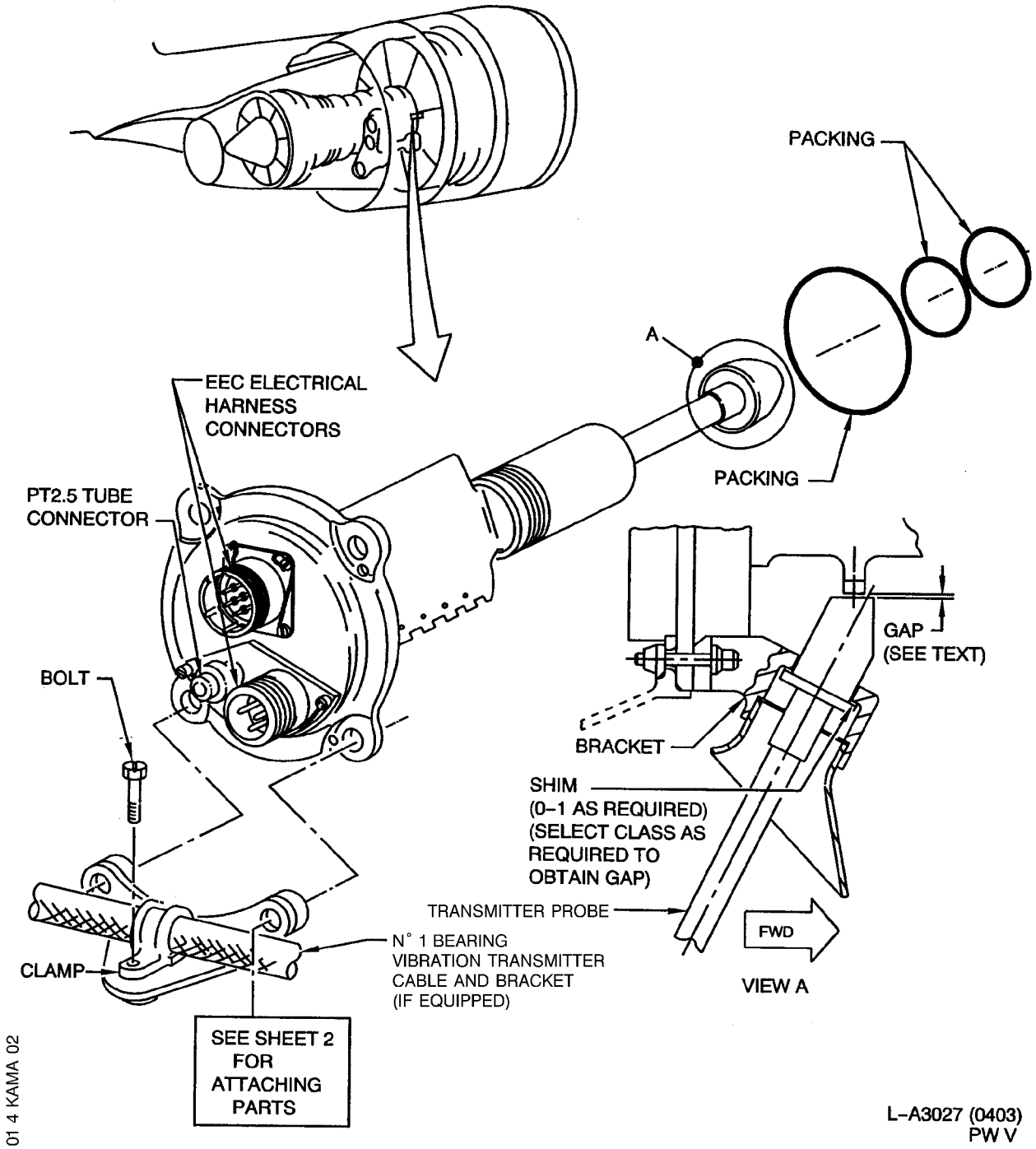
(2)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.

(3)Remove access platform.

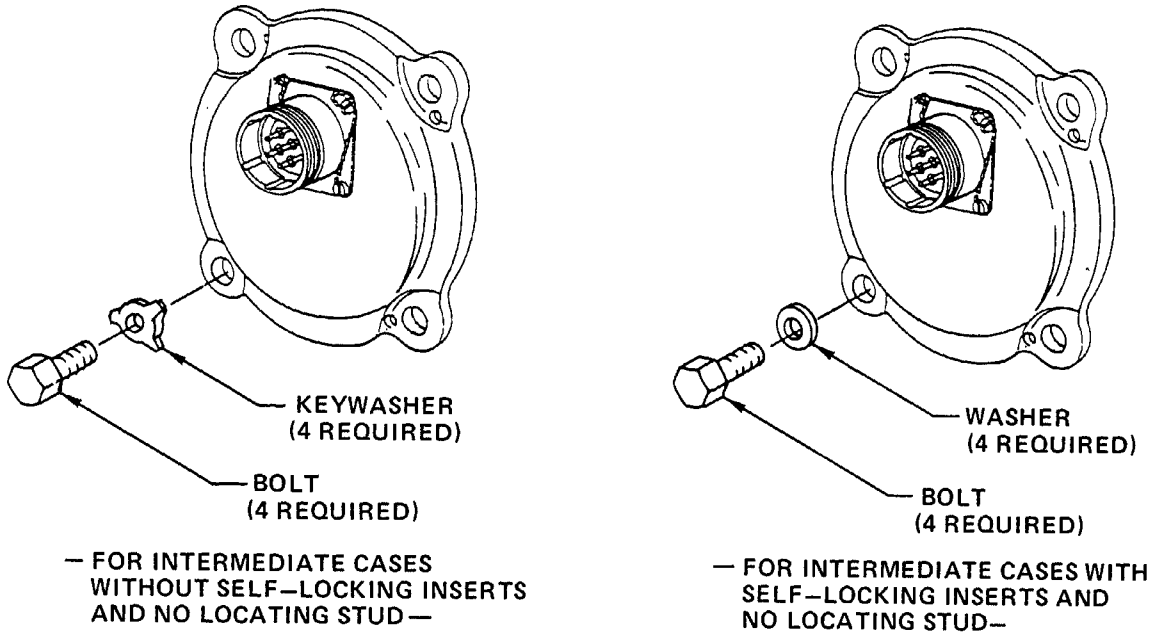
(4)Close fan cowl doors (Ref. 71-13-00, P. Block 301).

(5)Remove safety clips and tags and close circuit breakers 1JH, 2JH, 8JH 1KG, 1KM, 2KM, 4DA and 8DA.

(6)Test engine per Test Reference Table (Ref. 71-00-00, P. Block 501).



Tachometer Transmitter (N1) (Sheet 1/2)
Figure 401



Tachometer Transmitter (N1) (Sheet 2/2)
Figure 401

N1 RPM INDICATOR - REMOVAL/INSTALLATION

NOTE : Removal/Installation procedures for N1 RPM indicators on L and R engines are identical.

1. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Blanking Caps/Plugs
Referenced Procedure - 24-41-00, P. Block 301	AC External Power Control

2. Procedure

A. Job Set-Up
(1)Open, safety and tag the following circuit breakers :

PANEL	SERVICE	IDENT.	LOCATION
133VU	ENGINES/ENG1 N1 IND	1EJ	334/S69
133VU	ENGINES/ENG2 N1 IND	2EJ	334/S74
133VU	ENGINES/ENG1 & 2 IND MAX POINTER RESET	1ER	332/U74

B. Removal
(Ref. Fig. 401)
(1)On face of panel 4VU, remove two screws (1) attaching N1 RPM indicator.
(2)Remove N1 RPM indicator (3) from panel 4VU.
(3)Disconnect N1 RPM indicator and blank off plug and receptacle (2).

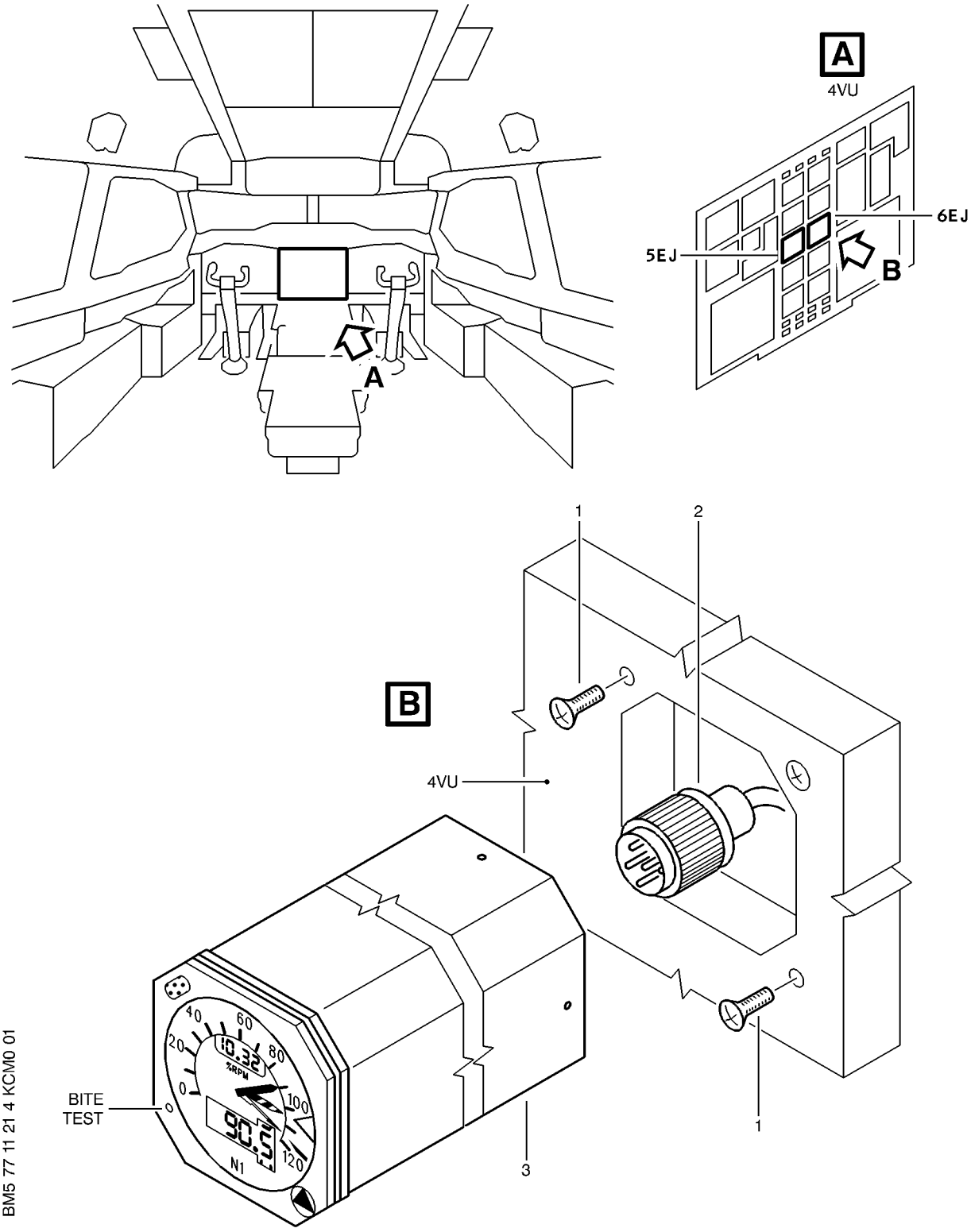
C. Installation
(1)Check housing of N1 RPM indicator on panel 4VU.
(2)Remove blanking caps from plug and receptacle (2) and connect plug.
(3)Install N1 RPM indicator (3) in panel 4VU.
(4)Attach N1 RPM indicator (3) to panel 4VU with two screws (1).
(5)Remove safety clips and tags and close circuit breakers 1EJ, 2EJ and 1ER.

D. Test
(1)Connect electrical ground power unit (Ref. 24-41-00, P. Block 301).
(2)Make certain that electrical supply is correct (115VAC, 28VDC, 26VAC).

ACTION	RESULT
(1)On panel 4VU - maintain slot of BITE screw R or Press-To-Test button, located in L lower section of N1 RPM indicator 5EJ (6EJ), in S R position or pressed in, respectively. R	On N1 RPM indicator 5EJ (6EJ) - the main and maximum pointer indicates 117 % ± 1 %. (the main and maximum pointer aligns with the blue mark).

ACTION	RESULT
	- the digital counter indicates 117 % ± 0.1 %.
- release **BITE** screw from S position or release Press-To-Test button.	- the main pointer returns to 0 percent position.
	- the maximum indicating pointer remains in front of the blue mark.
(2)On panel 472VU	On panel **4VU, N1 RPM** indicator 5EJ (6EJ)
- press **ENG/MAX POINTER RESET** pushbutton switch	- the maximum indicating pointer returns in front of the red mark.

E. Close-Up
(1)De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, P. Block 301).
(2)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(3)Restore aircraft systems to normal operating condition.



N1 RPM Indicator
Figure 401

R

N2 RPM INDICATING SYSTEM - DESCRIPTION AND OPERATION

1. Description

The N2 speed (High Pressure rotor) is provided through a dedicated winding of the FADEC N2 tachometer transmitter (Ref. 73-25-00, P. Block 1) mounted on the accessory gearbox.
The signal proportional to the High Pressure rotor speed is sent to the flight compartment indication.
This signal is processed by an indicator and displayed to the crew.
This signal is also used by the vibration system to set the control frequency of the tracking filter (Ref. 77-32-00, P. Block 1). Furthermore, when N2 reaches 45 %, a signal is sent to the starting system to close the start valve.

A. N2 RPM Tachometer Transmitter (Ref. Fig. 001)

This tachometer transmitter is a magnetic rotor which generates within a stationary coil a sine wave which frequency is proportional to N2 rpm (frequency : 1Hz = 0.35264 X N2 (rpm) = N2 (rpm)/2.8357
100 % N2 = 9900 rpm = 3491,2Hz).

B. N2 RPM Indicator

R **ON A/C 101-104,

R Post SB 72-2032 For A/C 101-104,

(Ref. Fig. 002)

**ON A/C 101-200,

(Ref. Fig. 003)
(Ref. Fig. 004)

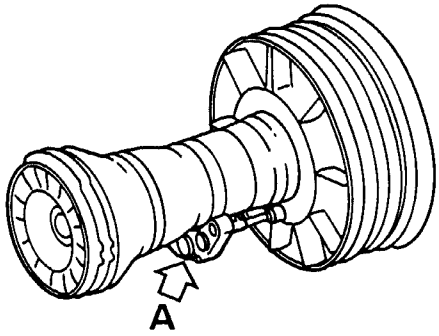
(1)Description

The N2 RPM indicator is located on the main instrument panel.
It receives the sensor signal and processes it to display N2 value in analog (pointer) and digital (counter) form. The last digit on the counter gives 0.1 %, but the overall accuracy is ± 0.2 %, in normal operating conditions. The digits are of LCD type.
This indicator is supplied with 115 V/400 Hz by a normal busbar.
The OVERSPEED pointer and overspeed warning are set to N2 = 104 % (red line limit).

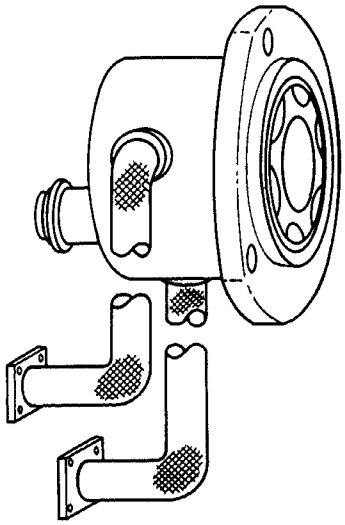
R **ON A/C 101-104,

R Post SB 72-2032 For A/C 101-104,

The OVERSPEED pointer and overspeed warning are set to N2 = 105.5 % (red line limit).



A



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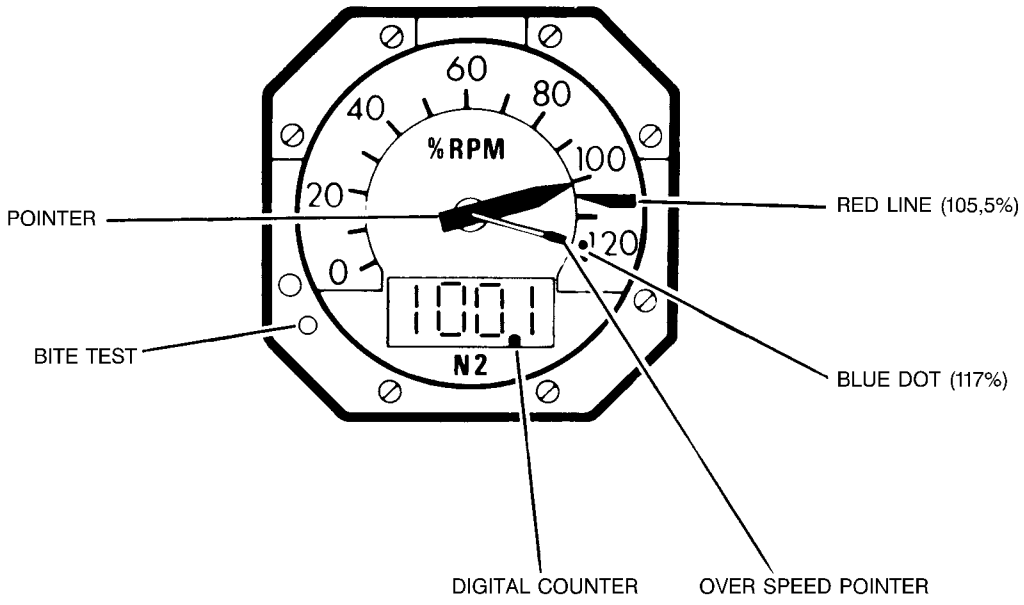
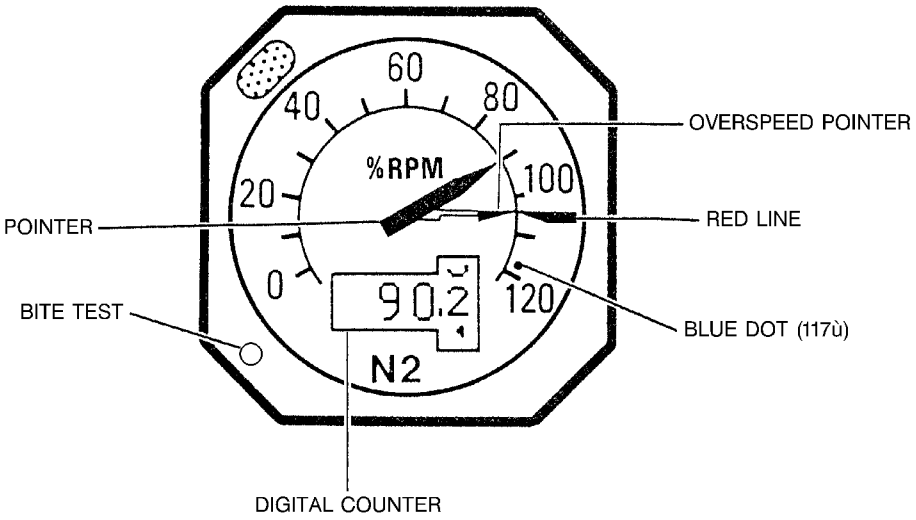
N2 Tachometer - Transmitter
Figure 001



BM5 77 12 00 0 KEL0 02

R

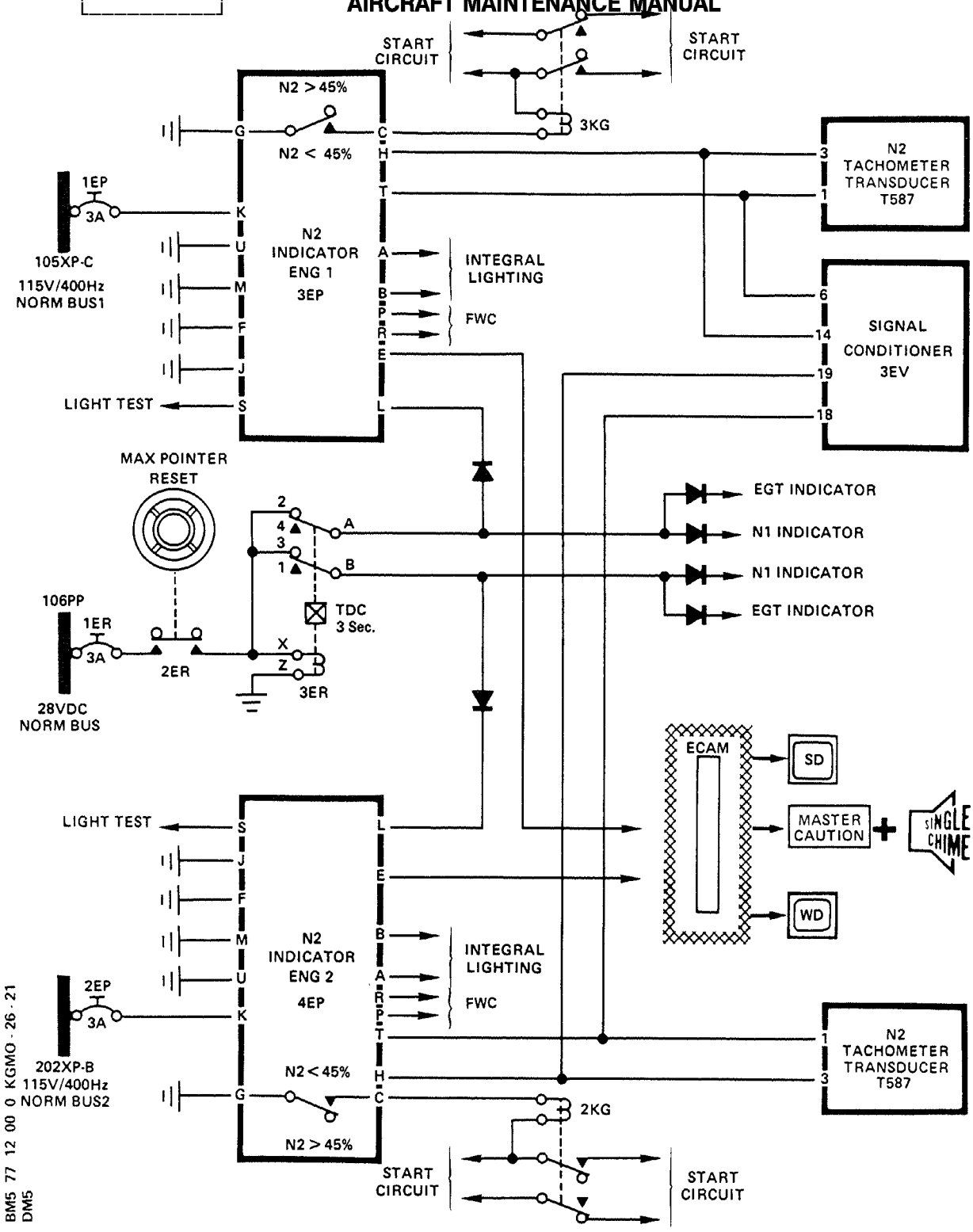
N2 RPM Indication
Figure 002



BM5 77 12 00 0 KEM0 02

N2 RPM Indication
Figure 003

R



N2 RPM Indicator - Electrical Circuit
Figure 004

**ON A/C 101-200,

Post SB 72-2032 For A/C 101-200,

When this speed is reached, the single chime is activated and the engine message displayed on the ECAM display unit, as well as the MASTER CAUTION light.
A MAX POINTER RESET signal can be activated (Ref. 77-14-00, P. Block 1) from the flight compartment.

(2)Indicator test

R (a)A BITE test is provided in the lower left corner of the indicator.
When the indicator is operating normally and BITE is selected by
R pressing the BITE test (A rod or small screw-driver is required).
- the LED matrix indicates the numeric value of the "blue dot" mark (117% N2 ± 0.2 %)
- the N2 pointer and OVERSPEED pointer go to the "blue dot" mark on the dial (117% N2 ± 0.1%).
- a message appears on the left ECAM DU associated with a MASTER CAUTION and SINGLE CHIME.
- the ENGINE system page appears on the right ECAM DU.

R When the BITE test is released the indicator returns to normal operation and warnings disappear.

**ON A/C 101-200,

When this speed is reached, the single chime is activated and the engine message displayed on the ECAM display unit, as well as the MASTER CAUTION light.
A MAX POINTER RESET signal can be activated (Ref. 77-14-00, P. Block 1) from the flight compartment.

(2)Indicator test

R (a)A BITE test is provided in the lower left corner of the indicator.
When the indicator is operating normally and BITE is selected by
R turning and maintaining the BITE test :
- the LED matrix sequentially indicates ROM, μP, ULA and then indicates the numeric value of the "blue dot" mark (117% N2 ± 1 %).
- the N2 pointer and OVERSPEED pointer go to the "blue dot" mark on the dial.
- a message appears on the left ECAM DU associated with a MASTER CAUTION and SINGLE CHIME.
- the ENGINE system page appears on the right ECAM DU.

R When the BITE test is released the indicator returns to normal operation and warnings disappear.
NOTE : The OVERSPEED pointer on the indicator will return to the red line value (104%) by pushing the MAX POINTER RESET pushbutton switch on panel 472VU.

**ON A/C 101-104,

R Post SB 72-2032 For A/C 101-104,

NOTE : The OVERSPEED pointer on the indicator will return to the red line value (105.5%) by pushing the MAX POINTER RESET pushbutton switch on panel 472VU.

**ON A/C 101-200,

(b) In case of failure (loss of signal or wrong signal, internal failure of the indicator), only the center element of each digit appears on the counter (---)
In case of power supply loss, the counter is black.

(c) On receipt of a ground signal from the light test pushbutton switch, (0.5 s minimum duration), all digits are black for less than one second, then all display 8 for less than one second. Then, if the test signal is not there anymore, each digit returns to pretest value.
If the test signal is still activated, a second test sequence starts.

C. Operational Usage
This indication is used to monitor starting and inflight relight (opening of HP fuel shut off valve at 15 % <N2<20 % - checking of automatic closure of the start valve at N2 = 45 %.

2. Component Location

**ON A/C 101-200,

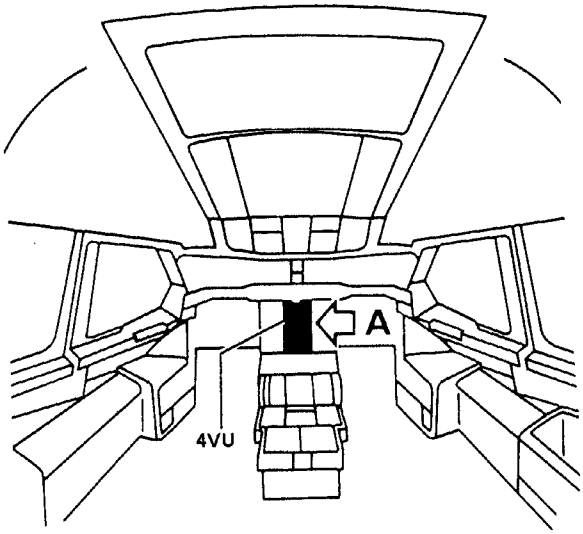
Post SB 72-2032 For A/C 101-200,

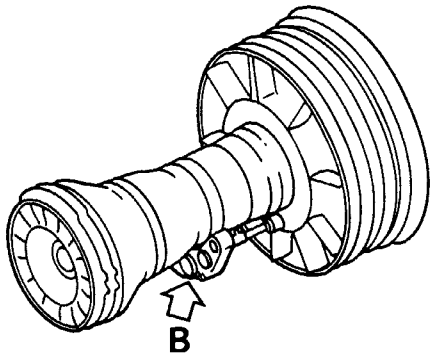
(Ref. Fig. 005)

**ON A/C 101-200,

(Ref. Fig. 006)

FIN	FUNCTIONAL DESIGNATION	PANEL	ZONE	ACCESS DOOR	ATA REF.
T587	TRANSMITTER TACHOMETER - N2		452	452AR	77-12-01
			462	462AR	77-12-01
3EP	INDICATOR - RPM, N2	4VU	211		77-12-12
4EP	INDICATOR - RPM, N2	4VU	212		77-12-12



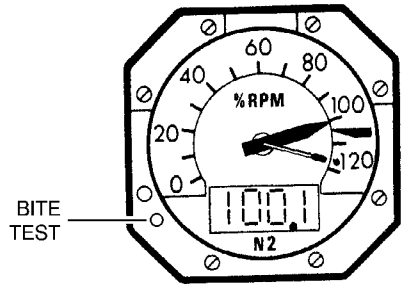


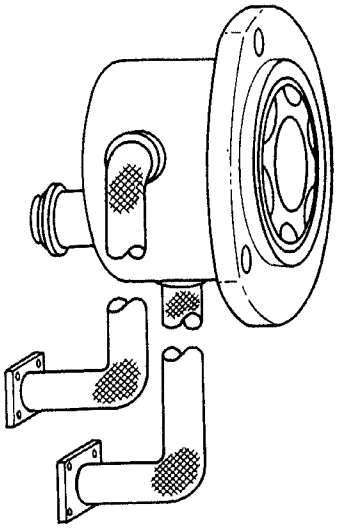
B

TRANSMITTER TACHOMETER N2

A

INDICATOR RPM N2





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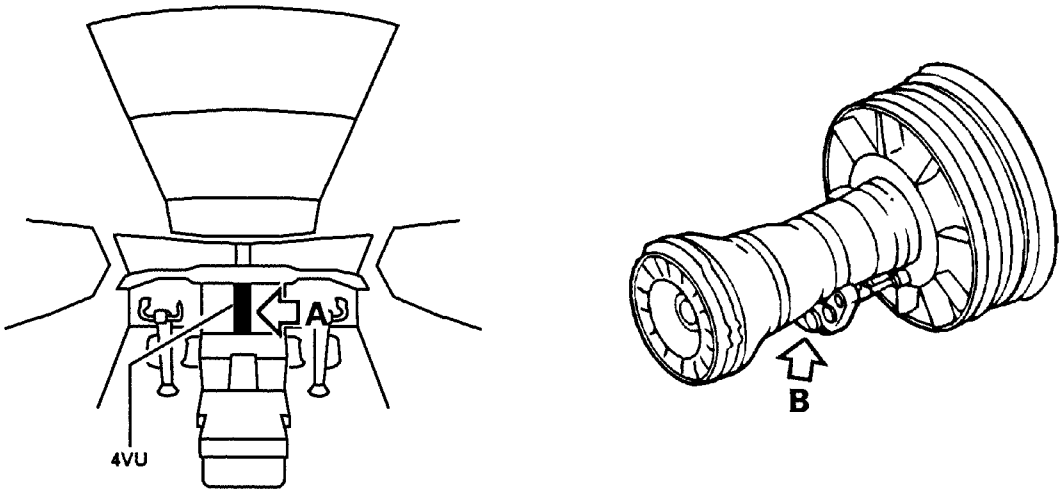
N2 RPM Indicating System - Component Location
Figure 005

R

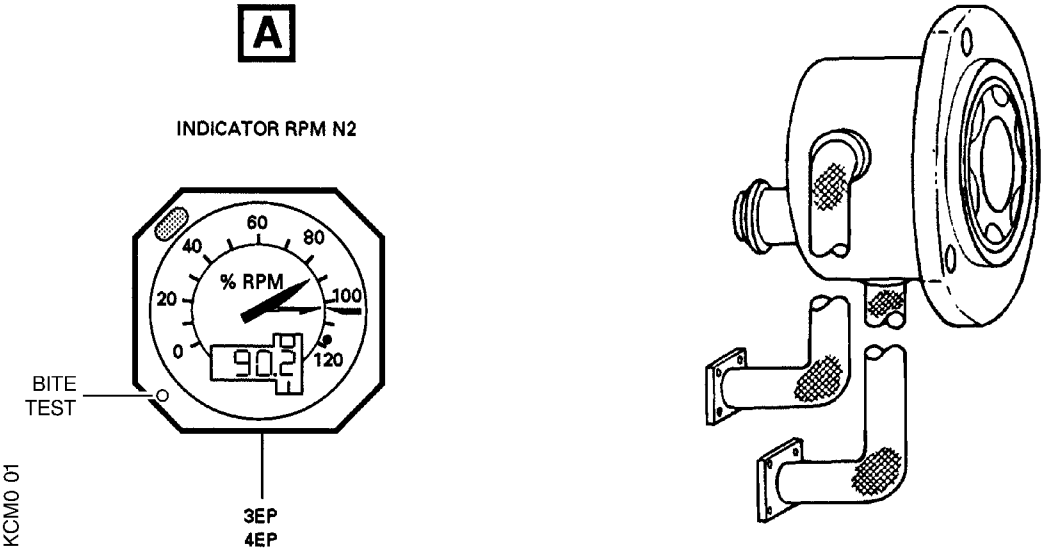


B

T 587
TRANSMITTER TACHOMETER N2

A

INDICATOR RPM N2



BM5 77 12 00 0 KCM0 01

N2 RPM Indicating System - Component Location
Figure 006

R

N2 RPM INDICATOR - REMOVAL/INSTALLATION

NOTE : Removal/Installation procedures for N2 RPM indicators on L and R engines are identical.

1. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Blanking Caps/Plugs
Referenced Procedure - 24-41-00, P. Block 301	AC External Power Control

2. Procedure

A. Job Set-Up
(1)Open, safety and tag the following circuit breakers :

	PANEL	SERVICE	IDENT.	LOCATION
	133VU	ENGINES/ENG1 N2	1EP	334/S70
R	133VU	ENGINES/ENG2 N2	2EP	334/S73
R	133VU	ENGINES/ENG1 & 2 IND MAX POINTER RESET	1ER	332/U74

B. Removal

**ON A/C 101-200,

Post SB 72-2032 For A/C 101-200,

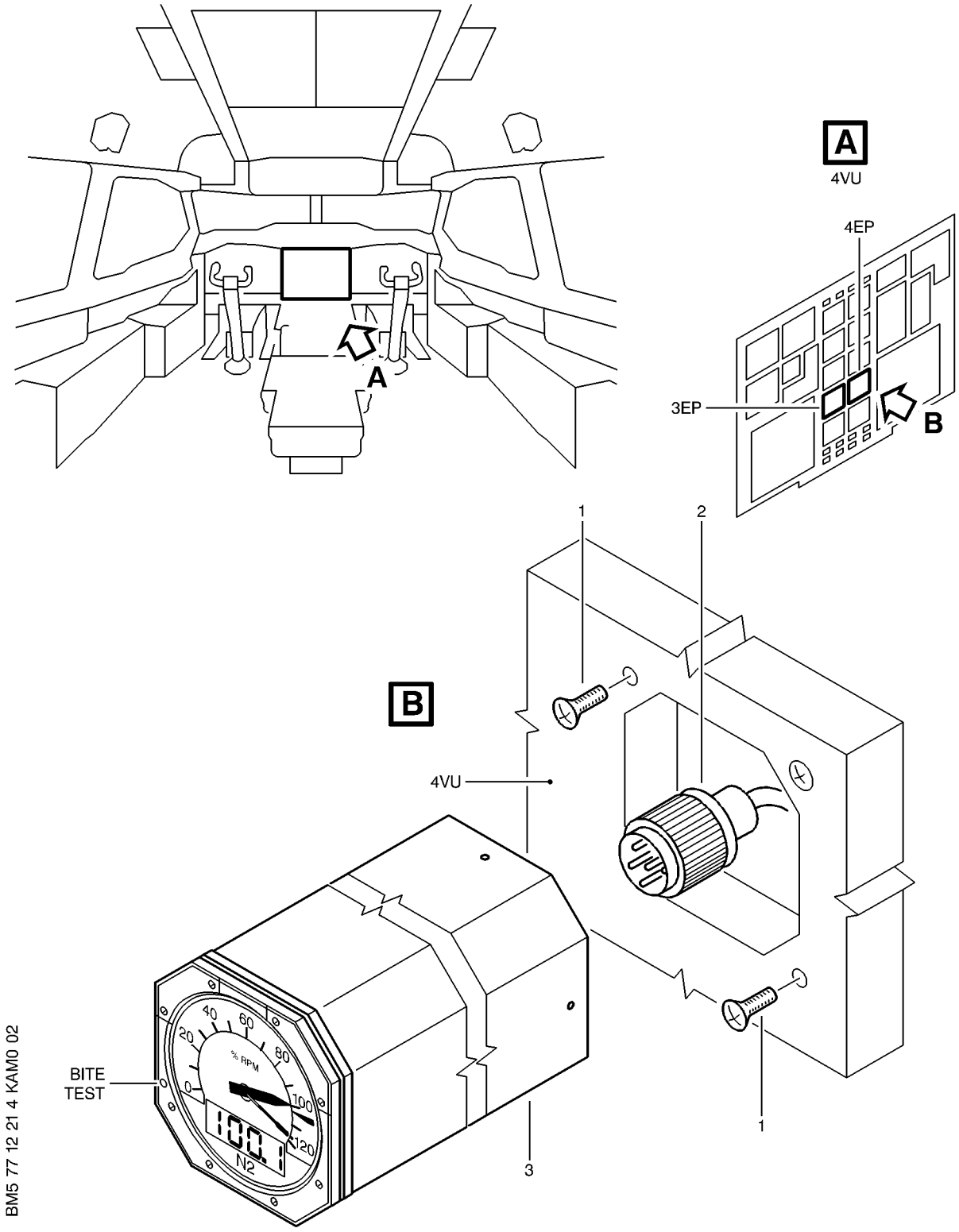
(Ref. Fig. 401)

**ON A/C 101-200,

(Ref. Fig. 402)
(1)On face of panel 4VU, remove two screws (1) attaching N2 RPM indicator.
(2)Remove N2 RPM indicator (3) from panel 4VU.
(3)Disconnect N2 RPM indicator and blank off plug and receptacle (2).

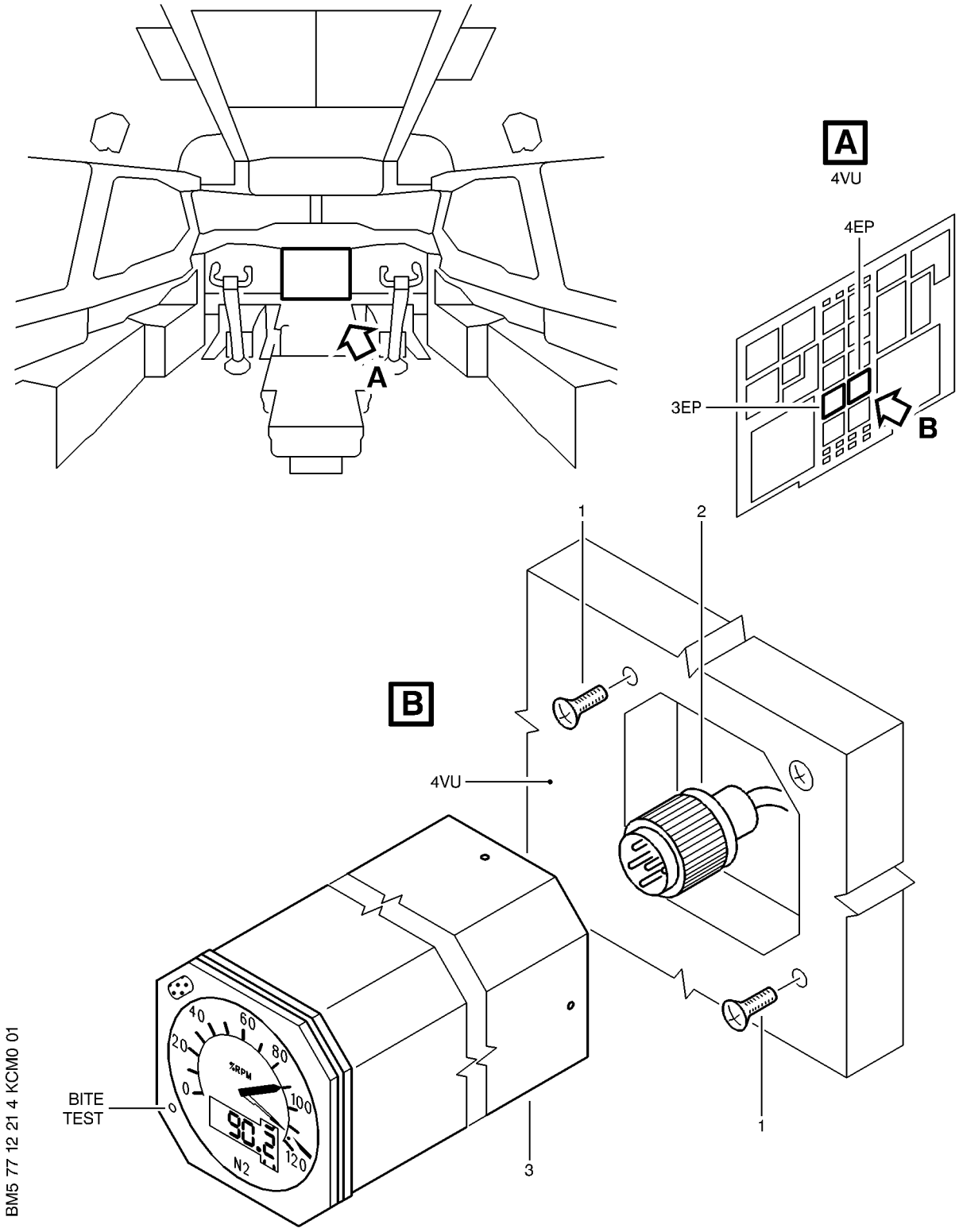
C. Installation
(1)Check housing of N2 RPM indicator on panel 4VU.
(2)Remove blanking caps from plug and receptacle (2) and connect plug.
(3)Install N2 RPM indicator (3) in panel 4VU.
(4)Attach N2 RPM indicator (3) to panel 4VU with two screws (1).
(5)Remove safety clips and tags and close circuit breakers 1EP, 2EP and 1ER.

**ON A/C 101-200,



N2 RPM Indicator
Figure 401

R



N2 RPM Indicator
Figure 402

R

D. Test (Ref. Fig. 401)
(1)Connect electrical ground power unit (Ref. 24-41-00, P. Block 301).
(2)Make certain that electrical supply is correct (28VDC, 115VAC, 26VAC).

ACTION	RESULT
(1)On panel 4VU R - maintain slot of BITE screw or R Press-To-Test button, located R in L lower section of N2 RPM R indicator 3EP (4EP), in S R position or pressed in, R respectively. R - release BITE screw from S R position or release Press-To- R Test button.	On N2 RPM indicator 3EP (4EP) - the main and maximum pointer indicates 117 % ± 1.0 % (the main and maximum pointer aligns with the blue mark). - the digital counter indicates 117 % ± 0.2 %. - the main pointer returns to 0 percent position. - the maximum indicating pointer remains in front of the blue mark.

**ON A/C 101-200,

D. Test
(1)Connect electrical ground power unit (Ref. 24-41-00, P. Block 301).
(2)Make certain that electrical supply is correct (28VDC, 115VAC, 26VAC).

ACTION	RESULT
(1)On panel 4VU - maintain slot of BITE screw R or Press-To-Test button, lo- cated in L lower section of N2 RPM indicator 3EP (4EP), in S R position or pressed in, R respectively. - release BITE screw from S R position or release Press-To- R Test button.	On N2 RPM indicator 3EP (4EP) - the main and maximum pointer indicates 117 % ± 1.0 % (the main and maximum pointer aligns with the blue mark). - the digital counter indicates 117 % ± 0.1 %. - the main pointer returns to 0 percent position. - the maximum indicating pointer remains in front of the blue mark.
(2)On panel 472VU, - press ENG/IND MAX POINTER/RESET pushbutton switch	On panel 4VU, N2 RPM indicator 3EP (4EP) - the maximum indicating pointer returns in front of the red mark.

E. Close-Up
(1)De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, P. Block 301).
(2)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.

(3)Restore aircraft systems to normal operating condition.

MAXIMUM POINTER RESET - DESCRIPTION AND OPERATION

1. Description (Ref. Fig. 001)
   MAX POINTER RESET pushbutton switch is located on the maintenance panel (120VU).
   It sends a signal for 3 seconds to :

   A. Both N1 Indicators

   B. Both N2 Indicators

   C. Both EGT Indicators
      When activated. This signal resets all the maximum pointers to their normal values (red limits), i.e. :
      N1 = 111.4%, N2 = 104%, EGT = 625°C
      This pushbutton switch is only a post flight item enabling the maintenance personnel to detect any overlimit indication.

R **ON A/C 101-104,

R Post SB 72-2032 For A/C 101-104,

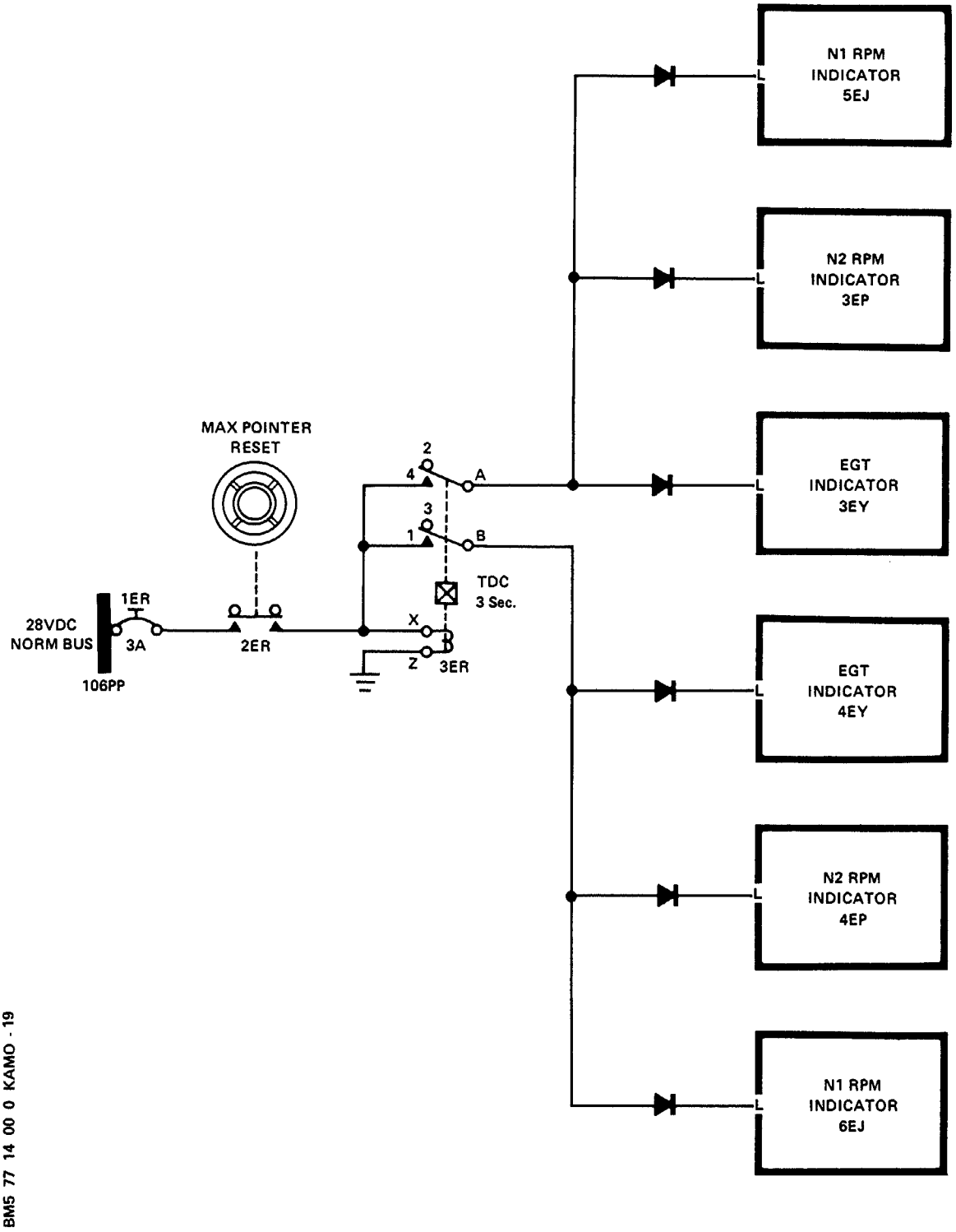
MAXIMUM POINTER RESET - DESCRIPTION AND OPERATION

1. Description (Ref. Fig. 001)
   MAX POINTER RESET pushbutton switch is located on the maintenance panel (120VU).
   It sends a signal for 3 seconds to :

   A. Both N1 Indicators

   B. Both N2 Indicators

   C. Both EGT Indicators
      When activated. This signal resets all the maximum pointers to their normal values (red limits), i.e. :
      N1 = 111.4%, N2 = 105.5%, EGT = 650°C
      This pushbutton switch is only a post flight item enabling the maintenance personnel to detect any overlimit indication.



Maximum Pointer Reset - Electrical Circuit
Figure 001

ENGINE PRESSURE RATIO - DESCRIPTION AND OPERATION

1. General

(Ref. Fig. 001)

EPR (Engine Pressure Ratio = PT 4.95/PT2) is the main thrust setting parameter.

One PT2 probe and 2 manifolded PT 4.95 probes are measuring respectively PT2 and PT 4.95.

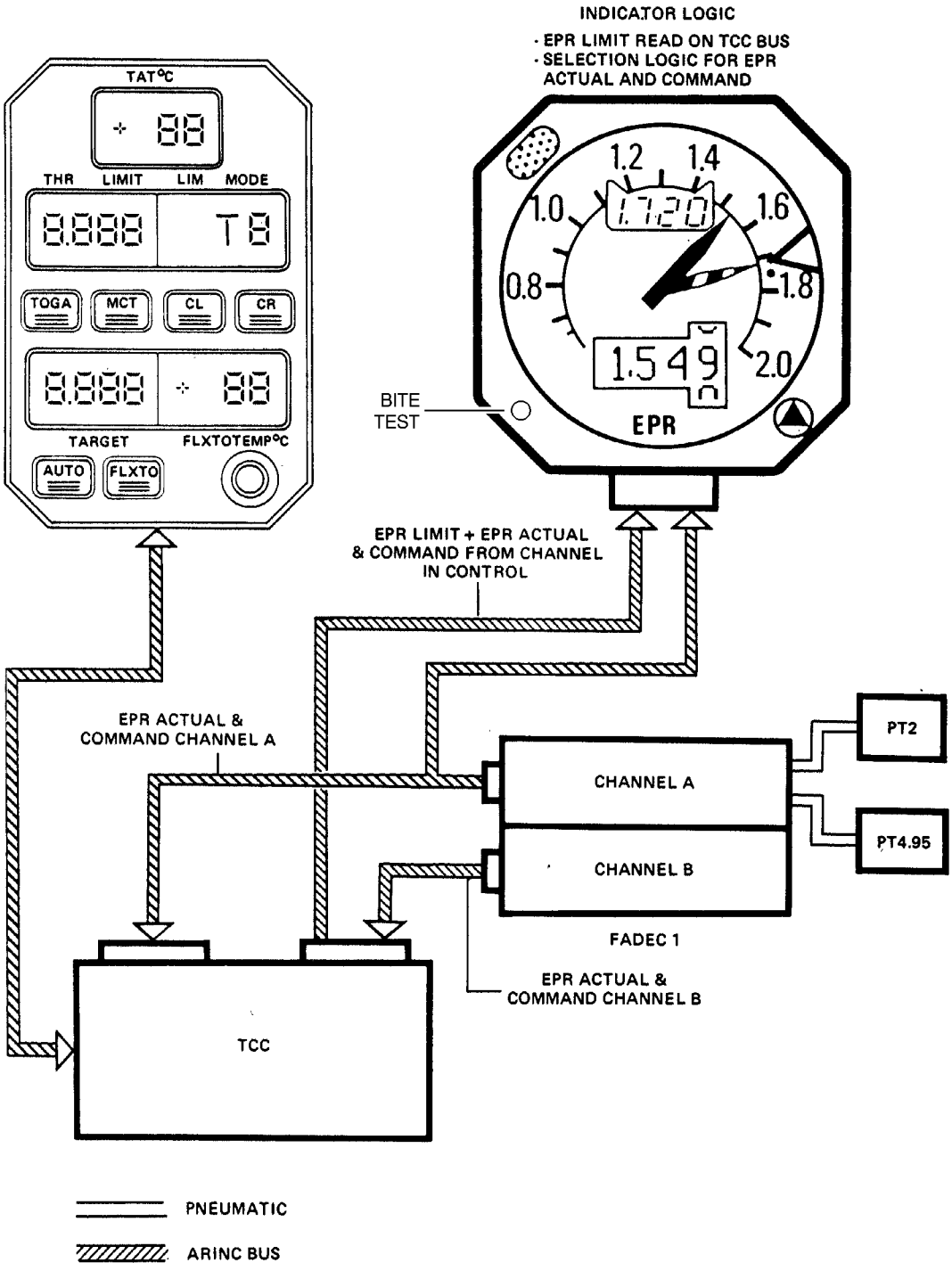
These pressures are pneumatically routed to the FADEC which calculates a PT 4.95/PT2 electrical signal.

This signal is part of the FADEC ARINC 429 data busbar and is used by the EPR indicator for display of the EPR actual and EPR command, which are defined by the FADEC.

This EPR indicator displays also the EPR limit (max EPR for the selected flight mode and flight conditions, received from the TCC).

The EPR indicator receives the EPR actual, EPR command and EPR limit signals on two ARINC bus input ports

- EPR actual and EPR command from the FADEC channel A
- EPR actual and EPR command from the FADEC controlling channel via the TCC which calculates the EPR limit.



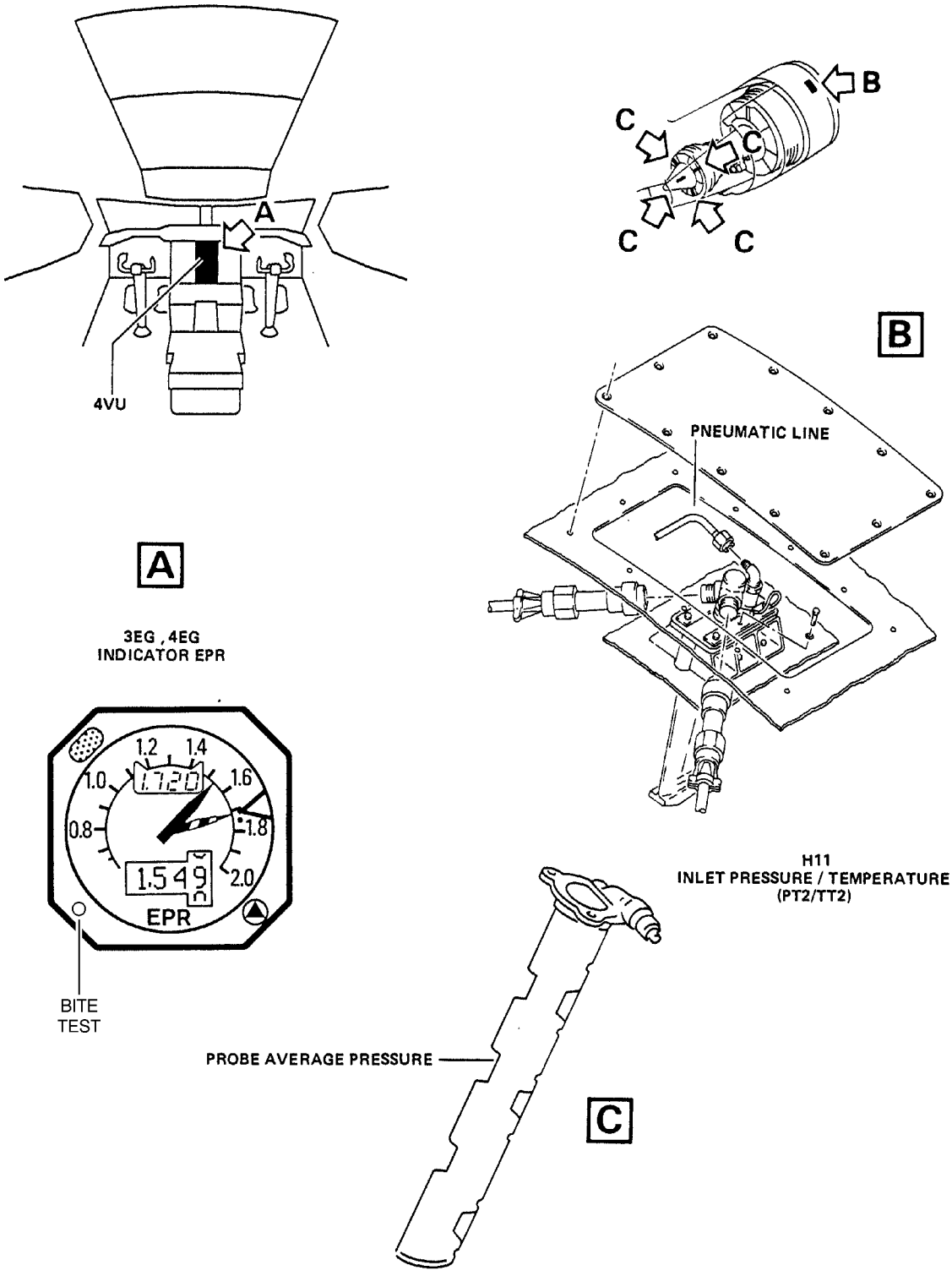
BM5 77 15 00 0 KCM0 01

EPR Indication
Figure 001

R

2. Component Location
(Ref. Fig. 002)

FIN	FUNCTIONAL DESIGNATION	PANEL	ZONE	ACCESS DOOR	ATA REF.
H11	INLET - PRESSURE/TEMPERATURE (PT2/TT2)		434	434AR	73-24-07
			444	444AR	73-24-07
	PROBE - AVERAGE PRESSURE (PT4.95)		455	451AL	77-15-01
			456	452AR	77-15-01
			465	461AL	77-15-01
			466	462AR	77-15-01
3EG	INDICATOR - EPR, ENG1	4VU	211		77-15-14
(4EG)	(ENG2)	4VU	212		



BM5 77 15 00 0 KAM0 01

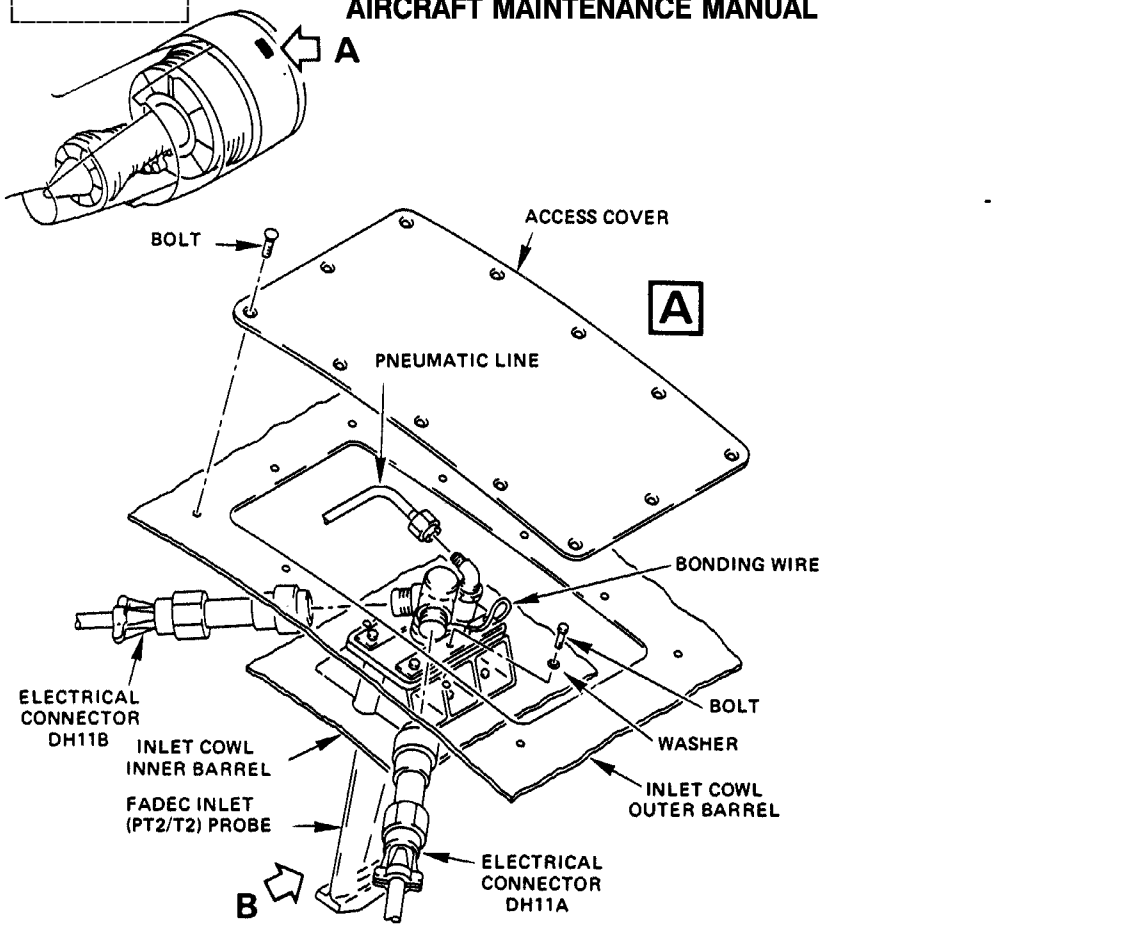
Engine Pressure Ratio - Component Location
Figure 002

R

3. PT2 and PT 4.95 Probes

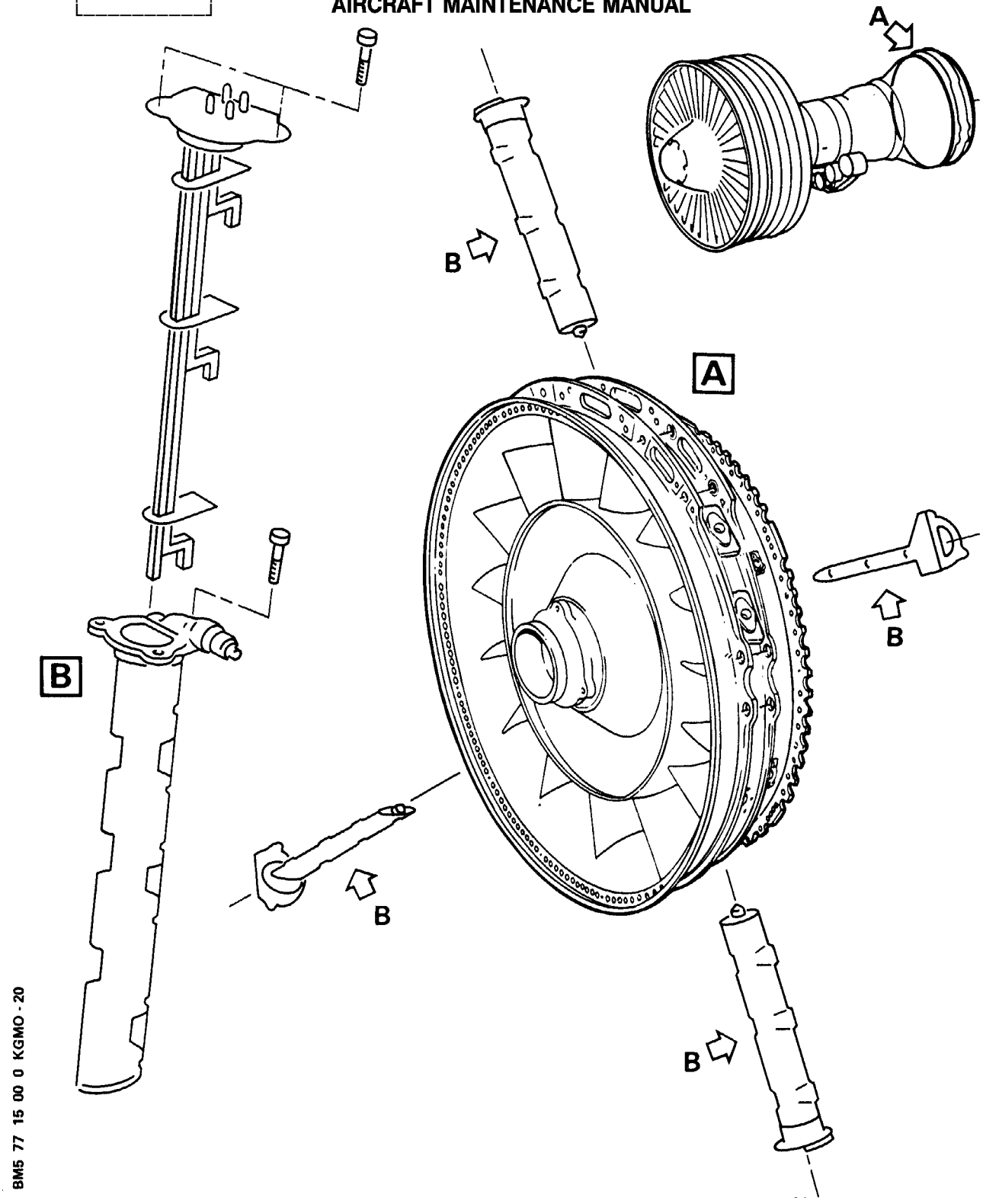
A. PT2 Probe (Ref. Fig. 003)
Located approximately 25 in. (635 mm) forward of engine flange A (station 2), near top dead center (12 o'clock), the combined PT2/Tt2 probe is electrically anti-iced to prevent any loss of pressure reference in case of icing conditions. This probe measures the total pressure at engine inlet and routes it pneumatically up to a PT2 port on the FADEC.
This signal is used by the FADEC to determine the actual EPR (see below).
To avoid any accumulation of water in this pipe, a water drain is provided at the lowest part of the pipe.
The Tt2 information is used by the FADEC to optimize the engine operating and performance characteristics.

B. PT 4.95 Probes (Ref. Fig. 004)
The two PT 4.95 exhaust gas average pressure probes measure average total outlet pressure at the turbine discharge and are mounted on the turbine exhaust case at the 4 and 10 o'clock positions. Probes extend into the turbine discharge passage.
Probes are manifolded together to measure average total outlet pressure (PT 4.95) at the turbine discharge.
The probes (PT 4.95) feature an airfoil type cross section to eliminate pressure loss caused by drag.
This PT 4.95 pressure is routed by a line along the engine, up to the FADEC PT 4.95 port.
As for the PT2 pneumatic line, a water drain is provided at the lowest point.



BM5 77 15 00 0 KEMO - 20

PT2 Probe
Figure 003



PT 4.95 Probes
Figure 004

4. Source Selection Logic
A logic is implemented in the indicator to select the source of information (Ref. Fig. 005, 006) :
- When all the signal sources are available and valid from the both FADEC channels (A and B), the logic selects the information coming from the channel in control.
- In case of failure of one signal, the logic uses the remaining valid information in order to keep the indication to the crew as long as possible.

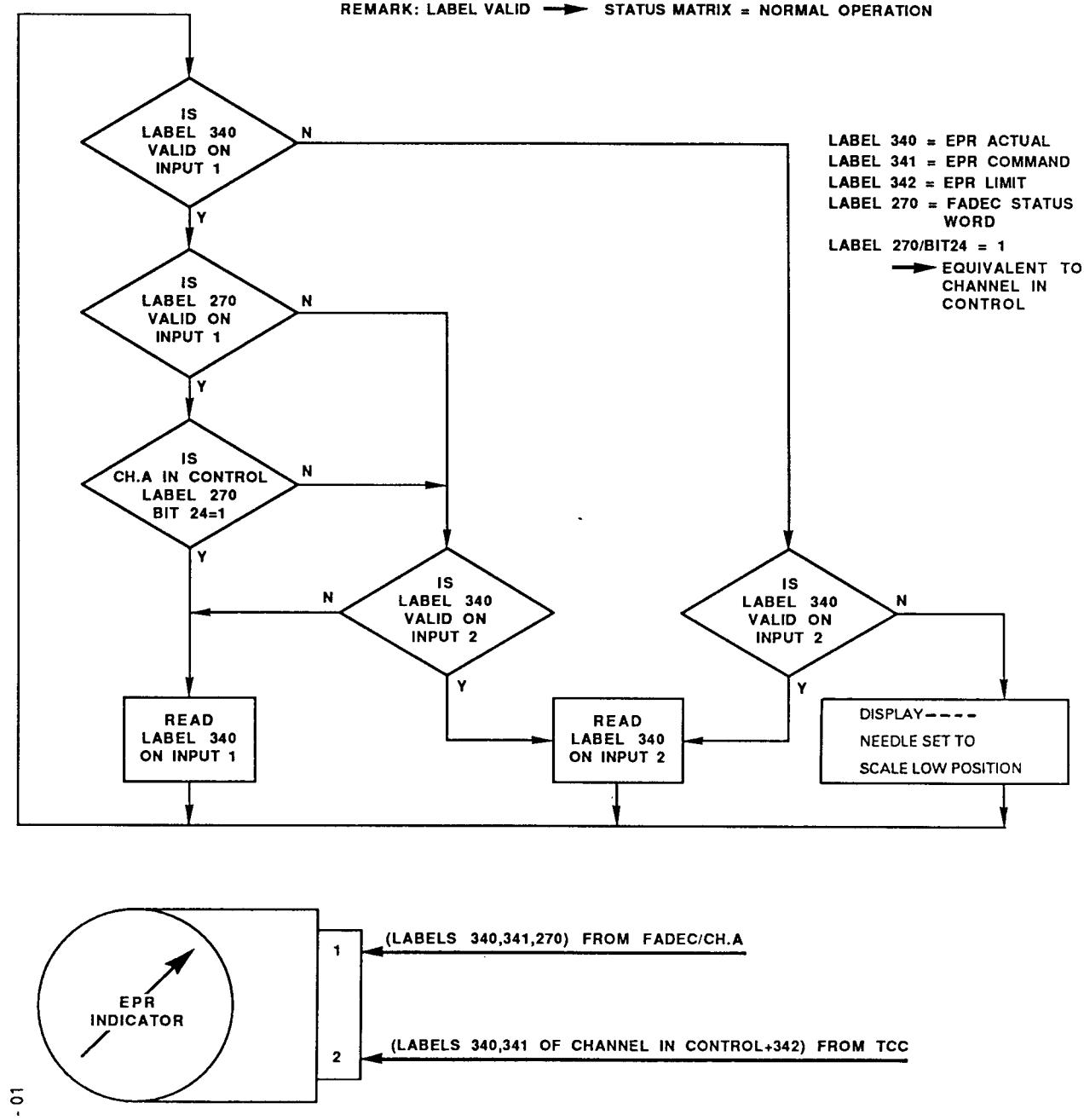
5. Signal Processing

A. Both PT2 and PT 4.95 pneumatic pressures are sensed in the FADEC by pressure transducers which convert them into frequencies. These frequencies are converted into a parallel digital form. These digital signals are processed by the FADEC to give a digital data busbar signal proportional to the PT 4.95/PT2 ratio = EPR actual (label 340) to be transmitted to the EPR indicator.
When sensing throttle control lever position (usage of TLA resolvers) and environmental conditions, the FADEC generates a signal of EPR command representing the EPR for the measured TLA and for the existing environmental conditions. This EPR command is transmitted via a digital busbar (label 341) to the EPR indicator.

6. EPR Indicator (Ref. Fig. 008)
(Ref. Fig. 007)
EPR indicator is located on the main instrument panel. It is the main parameter for thrust setting :

A. The EPR actual signal is received from the FADEC ARINC BUS (label 340).
It is processed by the indicator to be displayed in both analog (pointer) and digital (counter) formats. The EPR actual pointer is white and shifts in the range between 0.65 and 2. The counter is located in the lower part of the indicator. The digits are of LCD type.

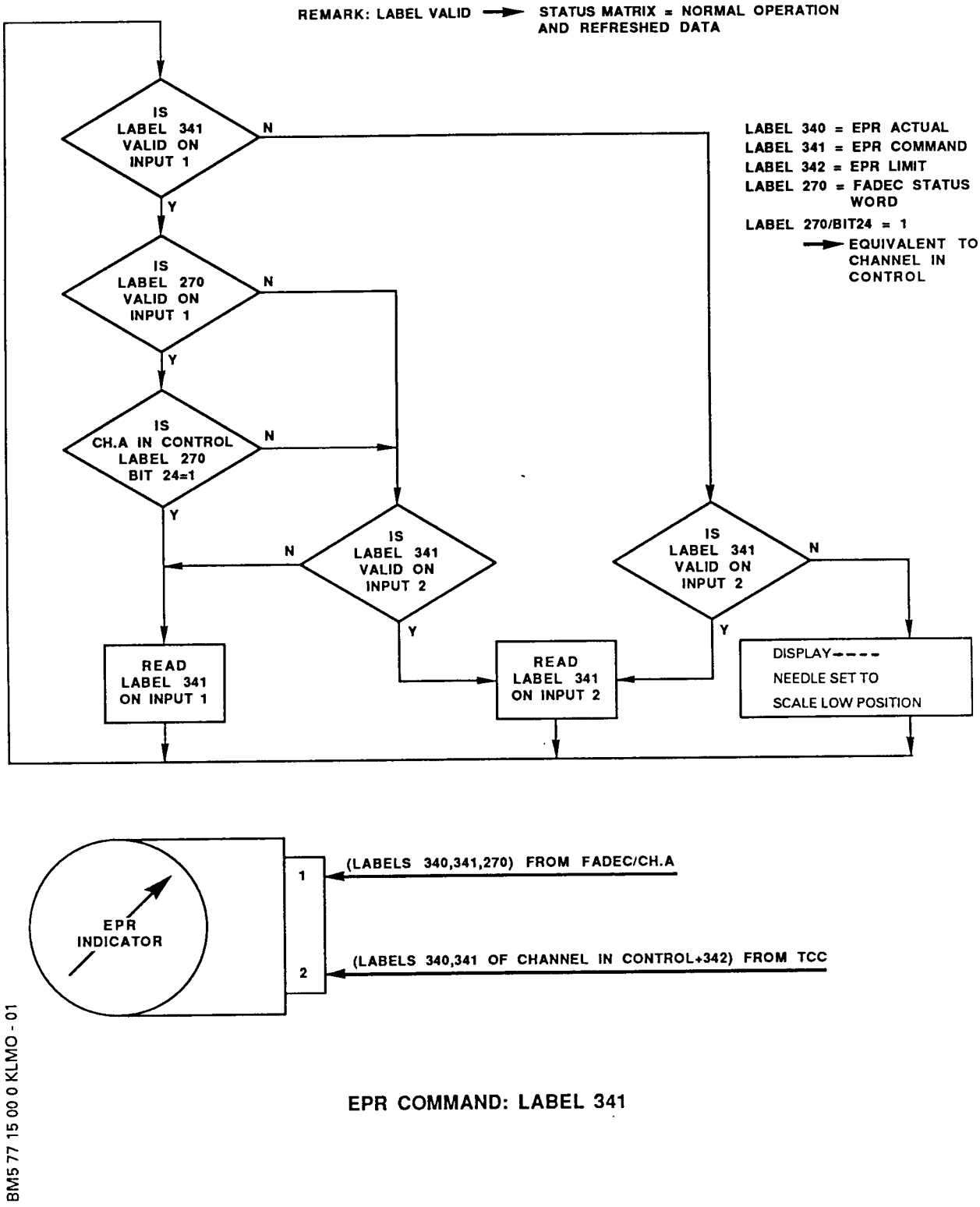
B. The EPR command signal is also received from the FADEC ARINC BUS (label 341).
It is displayed in analog format only by a black and white pointer, coaxial with the EPR actual pointer. In normal, steady condition, both pointers coincide.



BM5 77 15 00 0 KJMO - 01

EPR ACTUAL: LABEL 340

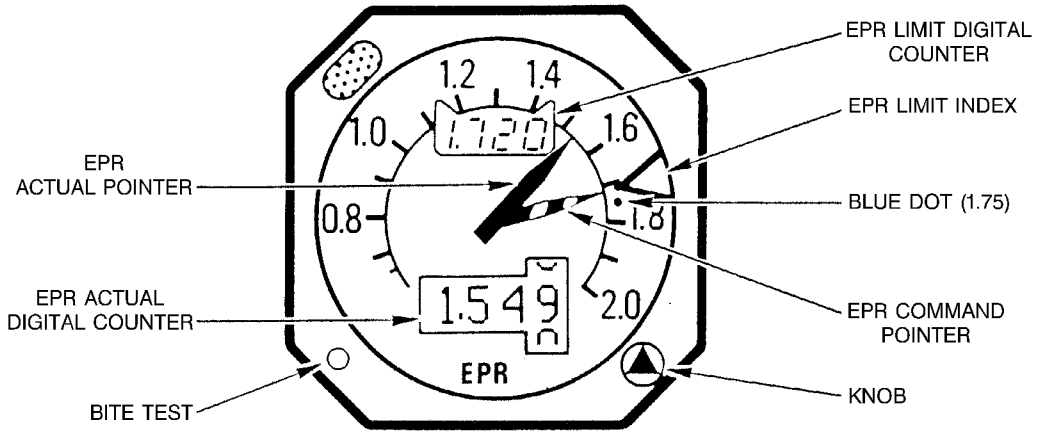
EPR Indication Selection Logic
Figure 005


REMARK: LABEL VALID → STATUS MATRIX = NORMAL OPERATION AND REFRESHED DATA
IS LABEL 341 VALID ON INPUT 1
N
Y
IS LABEL 270 VALID ON INPUT 1
N
Y
IS CH.A IN CONTROL LABEL 270 BIT 24=1
N
Y
IS LABEL 341 VALID ON INPUT 2
N
Y
IS LABEL 341 VALID ON INPUT 2
N
Y
READ LABEL 341 ON INPUT 1
READ LABEL 341 ON INPUT 2
DISPLAY----
NEEDLE SET TO SCALE LOW POSITION
LABEL 340 = EPR ACTUAL
LABEL 341 = EPR COMMAND
LABEL 342 = EPR LIMIT
LABEL 270 = FADEC STATUS WORD
LABEL 270/BIT24 = 1
→ EQUIVALENT TO CHANNEL IN CONTROL
EPR INDICATOR
1
2
(LABELS 340,341,270) FROM FADEC/CH.A
(LABELS 340,341 OF CHANNEL IN CONTROL+342) FROM TCC

BM5 77 15 00 0 KLMO - 01

EPR COMMAND: LABEL 341

EPR Indication Selection Logic
Figure 006

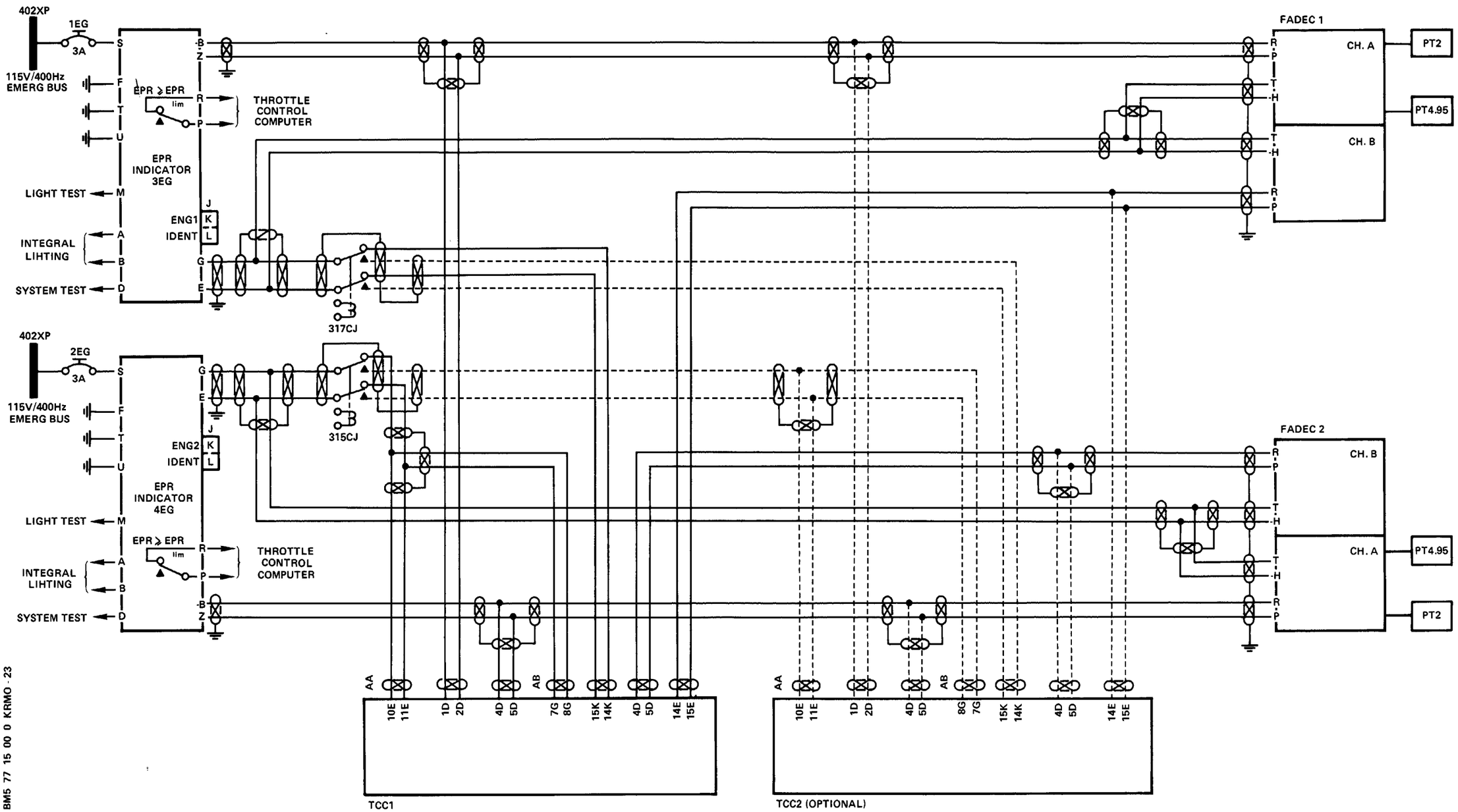


BM5 77 15 00 0 KPM0 01

EPR Indicator
Figure 007

R

INTENTIONALLY BLANK



BM5 77 15 00 0 KRMO 23

EPR Indicating - Electrical Circuit
Figure 008

C. EPR limit is also displayed, either manually or automatically.
The EPR limit is a function of the rating selected on the TRP by the crew (TO/GA, FLXTO, MCT, CL, CR) and of the ambient conditions, as defined by the power management curves. These curves are introduced into the Thrust Control Computer (TCC) which applies the relevant corrections for bleed and anti-icing conditions (Ref. 22-30-00, P. Block 1) : in case of failure of the TCC, the crew can derive the EPR limit from those curves, given in the Flight Manual.

(1)Manual setting of EPR limit
On the lower RH side corner of the indicators, a yellow knob can be pulled, then turned to set a yellow index on the external diameter in order to indicate the EPR limit, in analog format. In the same time the upper counter displays the EPR limit in digital format, using mechanical display.

(2)Automatic setting of EPR limit
When the above knob is pushed in, the EPR limit signals arrives from the TCC. This signal drives the index to the EPR limit determined and the EPR limit digital counter is blank. In case of EPR limit signal loss, the code AF (Auto Fail) is displayed on the EPR limit digital counter.

D. Comparison Switch
When set manually, the EPR limit signal is compared with the EPR actual signal, when both are identical (tolerance +0, -0.040), an overlimit switch inside the indicator sends a signal to declutch the autothrottle (if engaged).

E. Indicator Tests

(1)Internal monitoring is provided and is enabled at "switch on" of the 115VAC supply and on operation of the BITE screw located in the bezel of the indicator.

(a)At "switch on", FAIL appears on the numeric display and checks of the indicator internal systems are performed. In the event of all the checks being valid the FAIL indication is extinguished and the indicator returns to normal operation. If BITE is selected when FAIL is selected the numeric display then indicates which internal system is failed (ROM, µP, RAM, IP1 or IP2).

(b)When the indicator is operating normally and BITE is selected by
R turning and maintaining the BITE test :
- the LED matrix display sequentially indicates : ROM, RAM, µP, IP1, IP2 then the numeric value of the "blue dot" mark (1.75 +/-0.02).
- the EPR actual pointer, the EPR command pointer and EPR LIMIT index go to the "blue dot" mark on the dial.
- the display on the EPR Limit Digital Counter goes off.

R When the BITE test is released, the indicator returns to normal operation.

(2)On receipt of a ground signal from the light test pushbutton switch (0,5 s minimum duration), all the light emitting diodes in EPR numeric display and also all the bars of the 7 bars numeric display will be illuminate for less than 1 sec, then, if the test signalis not there anymore, each digit will return to the pretest value.
If the test signal is still actuated, a second test sequence starts.

F. Indication System Test (Ref. Fig. 008)

When the FADEC ground test is activated and the Thrust Control Computer powered, the actual EPR indications are given by the indicator through the selection logic.

In order to test the redundancies of the indications, a system test is available by selecting the FADEC BITE DISPLAY.

When the FADEC BITE DISPLAY GROUND TEST is selected with the test selector switch located on the maintenance test panel (120VU), the entire EPR indication system is tested. In this configuration, for EPR command or actual indication, the indication is flagged in case of failure (loss of at least one input signal to the indicator : total loss of the signal or invalid signal) : the center element of each digit will appear on the counter (----) and the pointer goes at the lower position. In absence of failure, the corresponding indication is maintained. To identify this test, the indicator receives a discrete (28VDC) from the test selection logic.

G. Failure Mode
(1)Without power supply
- the EPR actual pointer is at the lowest value (0.65) and the counter is black.
- the EPR command pointer stays in the same position as before power loss
- the EPR limit index (and counter) stays in the same position as before power loss
- the overlimit switch, even if it is closed, cannot declutch the autothrottle.

(2)EPR actual signal failure on both inputs (Ref. Fig. 005)
- the EPR actual pointer is driven to the lowest value (<0.65).
- the EPR actual counter displays (----).

(3)EPR limit signal failure on both inputs (Ref. Fig. 006)
In automatic mode, the index comes back to the lowest value (<0.65).

(4)EPR command signal failure
- the EPR command pointer comes back to the lowest value (<0.65).

7. Operational Usage

A. In a fully automatic mode, the EPR limit is indicated by the index as soon as the rating mode is selected on TRP, while the EPR command pointer reflects the TLA position. When the TLA position is fixed, the FADEC - FMU loop schedules the fuel flow to obtain EPR actual equal to EPR command.

B. In a manual mode, the crew must define the EPR limit and set it by means of the setting knob. The procedure is the same as in automatic mode.

ENGINE PRESSURE RATIO - ADJUSTMENT/TEST

1. General

A. Use this procedure to check the engine EPR P4.95 probes and sensing tubes for leaks. Repair any leaks found using this test.

B. There are two EPR P4.95 probes installed in the turbine exhaust case at approximately the 4 and 10 o'clock positions.

C. There are two types of EPR P4.95 probes. The Pre SB PW4ENG-77-16 probe has six sampling holes. The Post SB PW4ENG-77-16 has four sampling holes. This test procedure can be used for either probe configuration.

2. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breakers Safety Clips
B.	Regulated air or nitrogen gas supply source (see NOTE 1)
C.	Access Platform
D.	Hoses and fittings
E.	Torque Wrench
F. PWA102283	EPR P4.95 Probe Pressure Kit (see NOTE 2)
G. Material No.P05-007	Special Materials (Ref. 70-00-00)
H. Material No.P05-289	Special Materials (Ref. 70-00-00)
I. Material No.P05-291	Special Materials (Ref. 70-00-00)
J. Material No.P05-292	Special Materials (Ref. 70-00-00)
Referenced Procedure	
- 71-13-00, P. Block 301	Cowl Doors

NOTE 1 : The regulated air or nitrogen gas supply source must supply pressure between atmospheric and 10 psig (68.9 kPa). The gauge must be accurate within 10 percent. The equipment must have an isolation shutoff valve to isolate the EPR system from the pressure source. The air must be clean and dry.

NOTE 2 : The PWA102283 kit consists of two probe clamps and one reducer adapter.

NOTE : If you are testing a Pre SB PW4ENG-77-16 probe with six ports use the PWA102283 tool to blank off four ports, then use speed tape or other material that is easily removable to blank off the remaining two ports.

3. EPR P4.95 System Leak Test

A. Job Set-up

(1)Open, safety and tag appropriate circuit breakers and open the thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301).

(2)Install access platform.

B. Procedure (Ref. Fig. 501)

(1)Visually examine the EPR P4.95 sensing system for damage and/or leaks as follows :

(a)Make sure the tube connections are not loose.

(b)Make sure the tubes are not cracked or broken.

(c)Make sure the tubes are not chafed through at the clamp locations.

(d)Make sure the brackets which attach the tubes are not cracked, broken or loose.

(e)Make sure the hoses at the FADEC are not damaged.

WARNING : MAKE SURE THE ENGINE SHUTDOWN OCCURRED NOT LESS THAN 60 MINUTES BEFORE YOU DO THIS PROCEDURE. IF YOU DO NOT, YOU CAN CAUSE A BURN TO YOURSELF.

(2)Install a PWA102283 kit clamp to each of the two EPR P4.95 probes as follows :

(a)Put the clamp over the front of the probe with the ID marking towards the inner case and the rubber blockers over the four pressure sensing ports.

(b)With the clamp in the correct position, tighten the two knobs equally in small increments so that the blockers seal the four sensing ports.

CAUTION : DO NOT LET THE PRESSURE SUPPLY GO MORE THAN 10 PSIG (68.9 KPA) TO THE SENSING SYSTEM. HIGHER PRESSURE CAN CAUSE DAMAGE TO SOME EQUIPMENT, SENSORS OR PROBES. DO NOT LET THE AIR PRESSURE SUPPLY GO INTO THE FADEC. HIGH PRESSURE CAN CAUSE DAMAGE TO THE FADEC.

(3)Connect the pressure source as follows :

(a)Find the P4.95 sensing hose (AS13) connected to the bottom of the FADEC.

(b)Hold the adapter with a wrench and disconnect the hose (AS13) from the FADEC.

(c)Make sure you adjust the regulator to 0 psig (0 kPa) before you connect the pressure source to the system.

(d)Install and tighten the PWA102283 kit adapter to the open end of the hose (AS13).

(e)Attach the regulated pressure supply hose to the adapter on the hose (AS13).

(f)Supply 10 psig (68.9 kPa) to the system.

(4)Do the leak check as follows :

(a)With 10 psig (68.9 kPa) supplied to the system, close the shutoff valve to isolate the EPR P4.95 system from the source.

(b)The pressure in the system can decrease by no more than 0.5 psig (3.4 kPa) for between 30 and 60 seconds.

(c)Use Leak Check Fluid (Material No.P05-007) to find any leak between the FADEC and the probes.

CAUTION : BEFORE YOU REPAIR A LEAK, ADJUST THE PRESSURE TO 0 PSIG (0 KPA). IF YOU DO NOT DO THIS, THE AIR PRESSURE CAN INCREASE WHEN YOU REPAIR THE LEAK AND EXCEED THE LIMIT. DAMAGE TO THE SENSING SYSTEM CAN OCCUR.

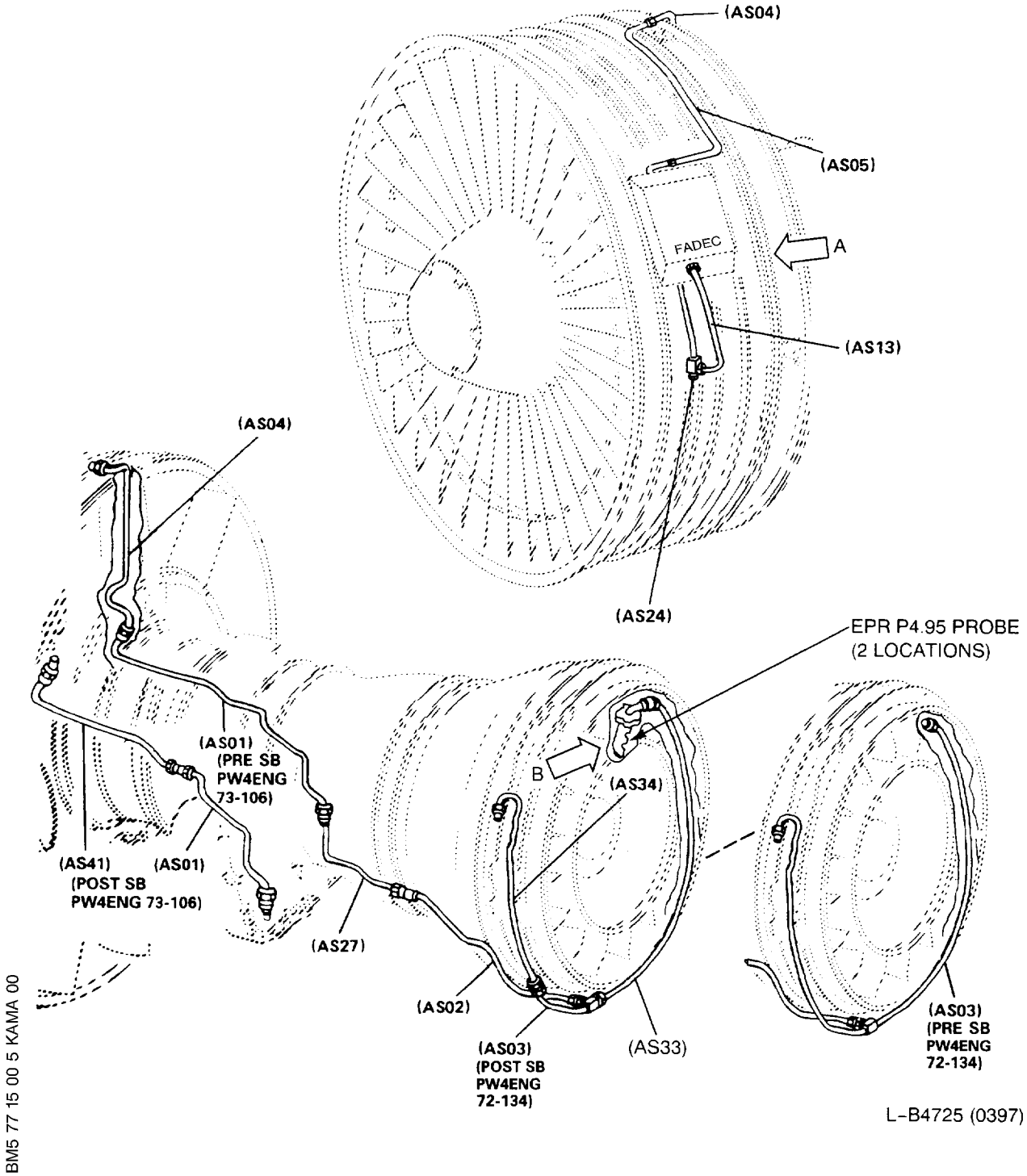
(5)Adjust the regulator to 0 psig (0 kPa).

(6)Repair all leaks as necessary.

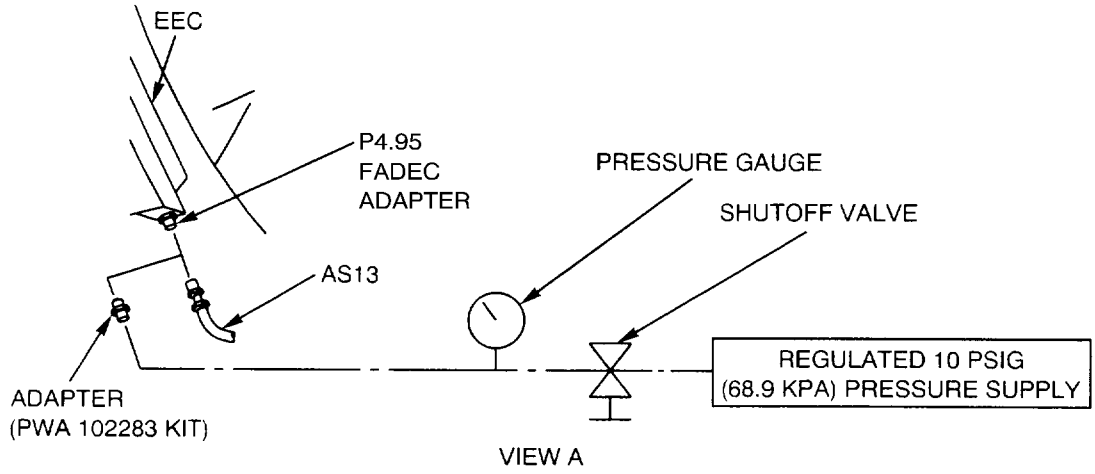
(7)After you repair any clogs or leaks, do the check again until all the leaks are repaired.

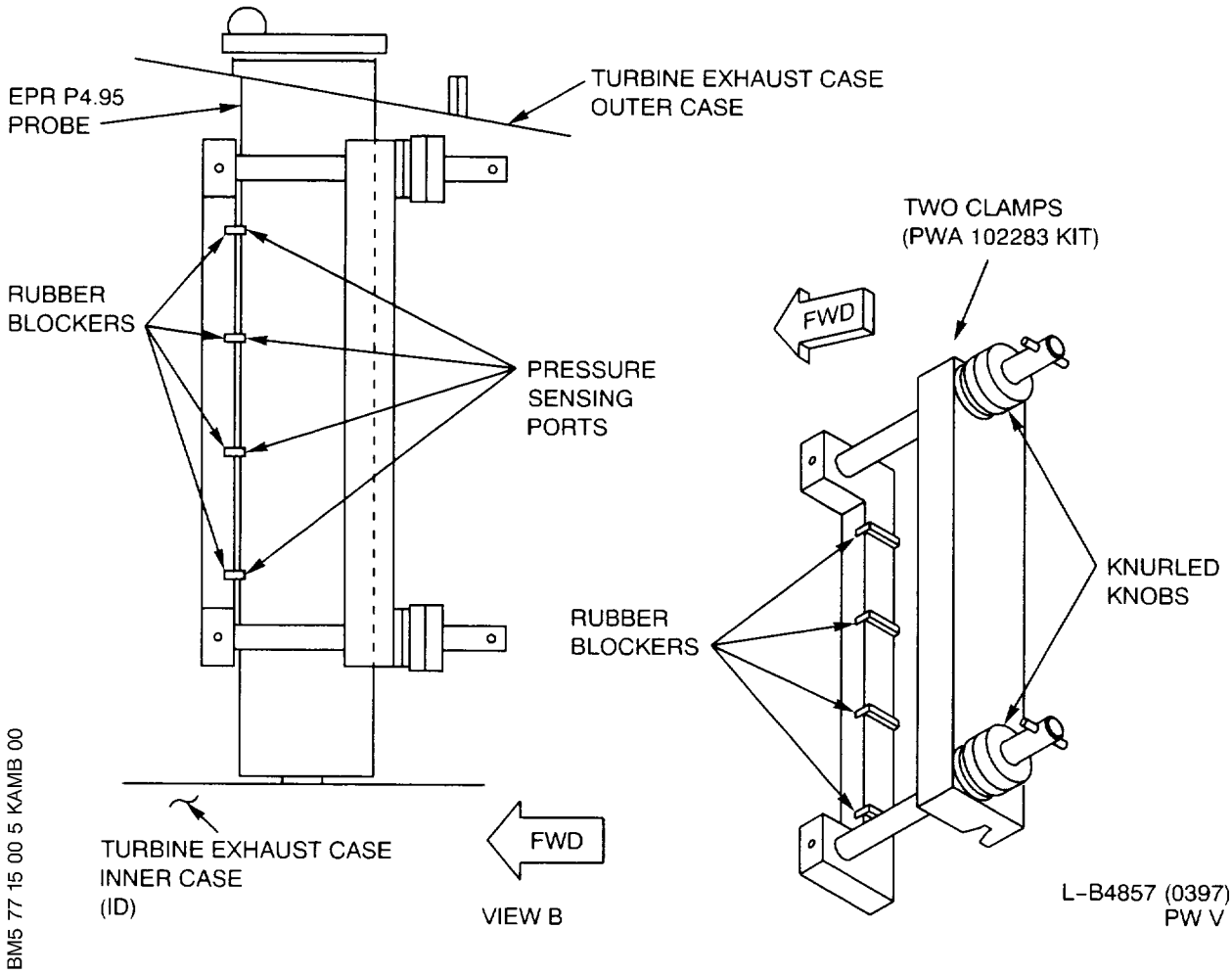
(8)If you still suspect a leak, remove the EPR P4.95 adapter from the bottom of the FADEC and inspect the packing.
(9)Remove the regulated pressure supply and the PWA102283 kit adapter from the sensing hose (AS13) and the clamps from the two probes.
CAUTION : DO NOT APPLY LUBRICANT TO ANY FADEC SENSING HOSE, TUBE, ADAPTER OR PACKING. CONTAMINATION OF THE FADEC CAN OCCUR.
(10)Connect the FADEC P4.95 sensing hose (AS13) to the FADEC as follows:
(a)Do not apply lubricant to the hose or adapter.
(b)Hold the FADEC adapter with a wrench and TORQUE the P4.95 sensing hose (AS13) to between 135 and 150 lbf.in. (1.53 and 1.69 m.daN).
(c)If the hose nuts have lockwire holes, install the Lockwire (Material No.P05-289) or Safety Cable (Material No.P05-291) and Safety Cable Ferrule (Material No.P05-292) to safety the hose nuts.
(11)Examine the four pressure sensing ports in the front of each probe to make sure there is no damage or blockage.

C. Close-up
(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(2)Remove the access platform.
(3)Close the thrust reverser and fan cowl doors, remove safety clips and tags and close circuit breakers (Ref. 71-13-00, P. Block 301).



EPR P4.95 Sensing System (Sheet 1)
Figure 501





EPR P4.95 Sensing System (Sheet 2)
Figure 501

AVERAGE PRESSURE PROBE (PT4.95) - REMOVAL/INSTALLATION

1. Equipment and Materials

ITEM	DESIGNATION
A.	Access Platform
B.	Circuit Breaker Safety Clips
C.	Protective Caps
D.	Torque Wrench
E.	Bergen Mechanical Crimper (optional) Model M303, M305 or M307
F. Material No.P03-001	Oils (Ref. 70-00-00)
G. Material No.P05-289	Special Materials (Ref. 70-00-00)
H. Material No.P05-291	Special Materials (Ref. 70-00-00)
I. Material No.P05-292	Special Materials (Ref. 70-00-00)
J. Material No.P06-023	Lubricants (Ref. 70-00-00)
Referenced Procedures	
- 71-00-00, P. Block 501	Power Plant - General
- 71-13-00, P. Block 301	Cowl Doors
- 77-15-00, P. Block 501	Engine Pressure Ratio (EPR)

2. Procedure

A. Job Set-Up

(1)Open, safety and tag the following circuit breakers :

PANEL	SERVICE	IDENT.	LOCATION
FOR ENGINE 1			
133VU	ENG1/SCU SUPPLY GND	35KS	333/T76
133VU	ENG1/SCU SUPPLY FLT	37KS	333/T75
FOR ENGINE 2			
133VU	ENG2/SCU SUPPLY GND	34KS	333/T85
133VU	ENG2/SCU SUPPLY FLT	36KS	333/T84

(2)Install access platform.

(3)Open fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

B. Removal (Ref. Fig. 401, 402)

(1)Remove four nuts and washers, at each location, securing cable to thermocouple studs.

(2)Remove cable ends from thermocouple at each location.

(3)If required, remove pressure probe at Location A.

(a)Remove the bolt and nut from the clamp on the thermocouple wires and the brazed on bracket on the PT 4.95 manifold (Post SB PW4ENG 72-234).

(b)Remove the lockwire or safety cable and disconnect the PT 4.95 manifold from the adapter on the pressure probe.

(c)Remove the lockwire or safety cable and the two bolts that attach the thermocouple to the exhaust case. Remove the thermocouple.

(d)Remove the remaining bolt. Remove the pressure probe and install

protection covers.

(4)If required, remove pressure probe at Location C.

(a)Remove the bolt and nut from the clamps on the thermocouple wires and PT 4.95 manifold (Post SB PW4 ENG 72-134).

(b)Remove the lockwire or safety cable and disconnect the PT 4.95 manifold from the adapter on the pressure probe.

(c)Remove the lockwire or safety cable and the two bolts that attach the thermocouple and the cable bracket.

(d)Loosen the cable bracket bolt and move the bracket to remove the thermocouple.

(e)Remove the remaining bolt. Remove the pressure probe and install protection covers.

C. Installation (Ref. Fig. 401, 402)

(1)Remove protective closures.

(2)If required, install pressure probe at Location A.

(a)Insert pressure probe into exhaust case opening aligning boltholes.

(b)Install thermocouple to pressure probe aligning boltholes and secure with bolts, threads lubricated with Silver Goop (Material No.P06-023).

(c)TORQUE bolts to between 54 and 60 lbf.in. (0.61 and 0.67 m.daN). Install the Lockwire (Material No.P05-289) or the Safety Cable (Material No.P05-291) and Safety Cable Ferrule (Material No.P05-292) to safety the bolts.

(3)If required, install pressure probe at Location C.

(a)Swing cable bracket away and insert pressure probe into exhaust case opening aligning boltholes.

(b)Install thermocouple to pressure probe aligning boltholes and align cable bracket. Secure with bolts, threads lubricated with Silver Goop (Material No.P06-023).

(c)TORQUE bolts to between 54 and 60 lbf.in. (0.61 and 0.67 m.daN). Install the Lockwire (Material No.P05-289) or the Safety Cable (Material No.P05-291) and Safety Cable Ferrule (Material No.P05-292) to safety the bolts.

(d)TORQUE clamp bolt on bracket to between 36 and 40 lbf.in. (0.41 and 0.45 m.daN).

CAUTION : DO NOT USE LUBRICANTS ON FADEC SENSING TUBES, ADAPTERS, OR PACKINGS. CONTAMINATION OF FADEC CAN RESULT.

(4)Attach PT 4.95 manifold to adapter. TORQUE manifold nut to between 135 and 150 lbf.in. (1.53 and 1.69 m.daN). Install the Lockwire (Material No.P05-289) or the Safety Cable (Material No.P05-291) and Safety Cable Ferrule (Material No.P05-292) to safety the manifold nut.

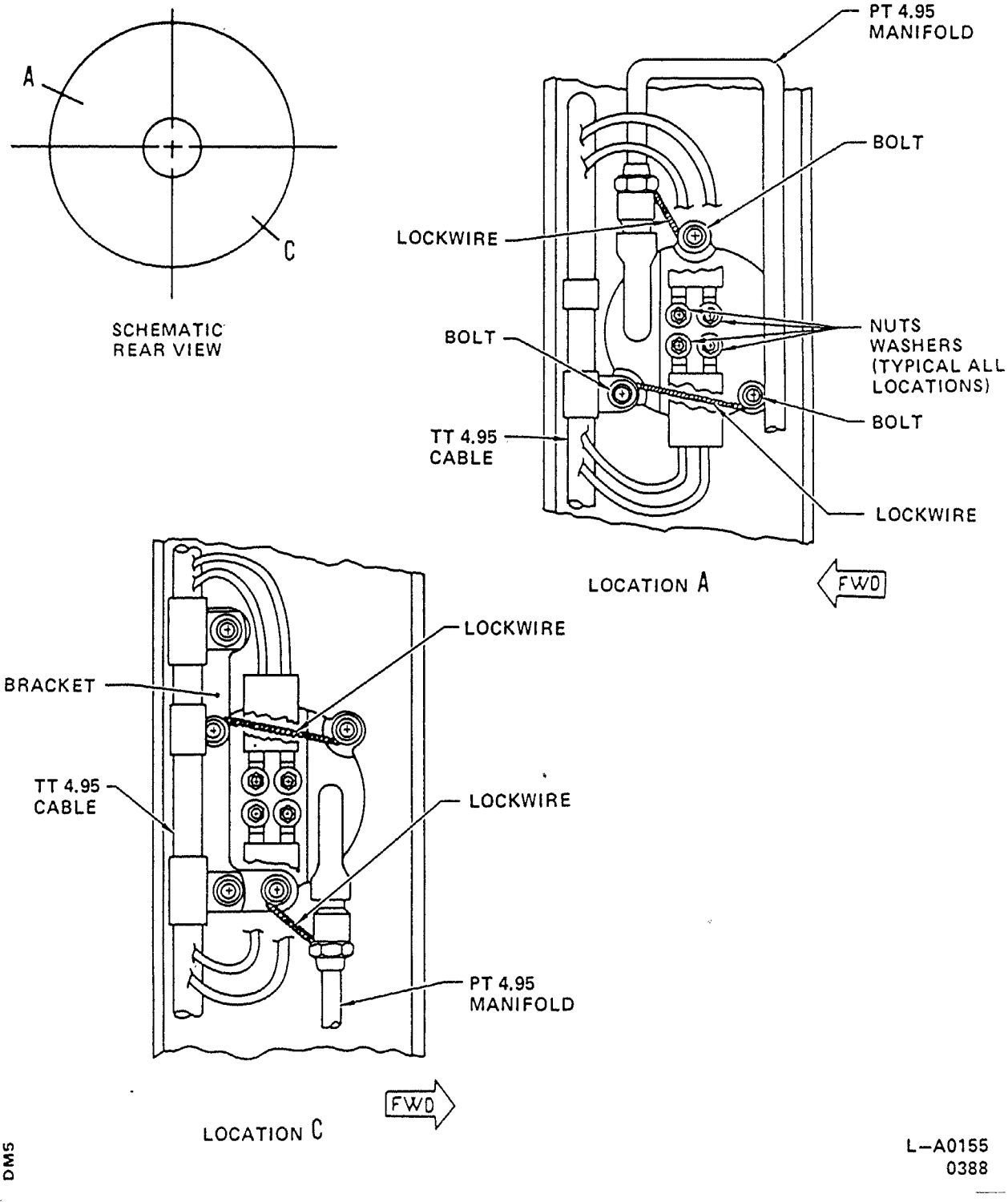
(5)Connect cable leads to thermocouple studs and secure with washers and nuts.

CAUTION : TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

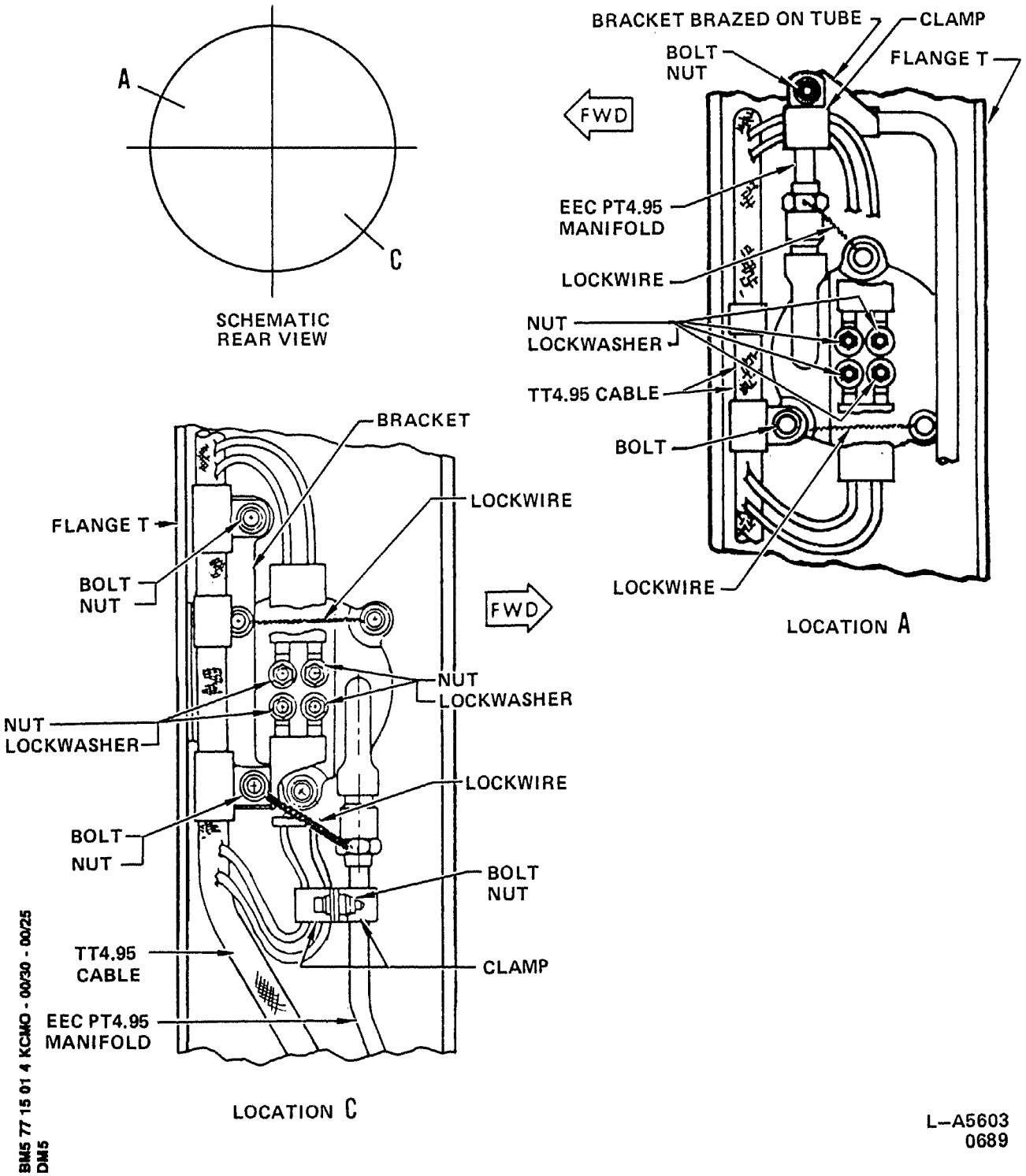
(6)TORQUE alumel nuts (larger) to between 10 and 15 lbf.in. (0.12 and 0.16 m.daN).

(7)TORQUE chromel nuts (smaller) to between 8 and 12 lbf.in. (0.10 and 0.13 m.daN).

(8)At location A install the thermocouple wires to the bracket (brazed) on the PT 4.95 manifold with a clamp, bolt, threads lubricated with Engine



Average Pressure and Temperature Probes (Pre SB PW4. 72-124)
Figure 401



Average Pressure and Temperature Probes (Post SB PW4. 72-124)
Figure 402

Oil (Material No.P03-001) and a nut. TORQUE the bolt to between 36 and 40 lbf.in. (0.41 and 0.45 daN), (Post SB PW4 ENG 72-234).

(9)At location C install the thermocouple wires to the clamp on the PT 4.95 manifold with a clamp, bolt, threads lubricated with Engine Oil (Material No.P03-001) and nut. TORQUE the bolt to between 36 and 40 lbf.in. (0.41 and 0.45 m.daN) (Post SB PW4 ENG 72-134).

D. Close-Up and Test

(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.

(2)Do a leak test of the EPR P4.95 System (Ref. 77-15-00, P. Block 501).

(3)Remove access platform.

(4)Close thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301).

(5)Remove safety clips and tags and close circuit breakers : 35KS, 37KS, 34KS, 36KS.

(6)Test engine per Test Reference Table (Ref. 71-00-00, P. Block 501).

AVERAGE PRESSURE PROBE (PT 4.95) - INSPECTION/CHECK

R 1. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Access Platform
Referenced Procedures	
- 71-13-00, P. Block 301	Cowl Doors
- 77-15-01, P. Block 401	Average Pressure Probe (PT 4.95)

2. Procedure

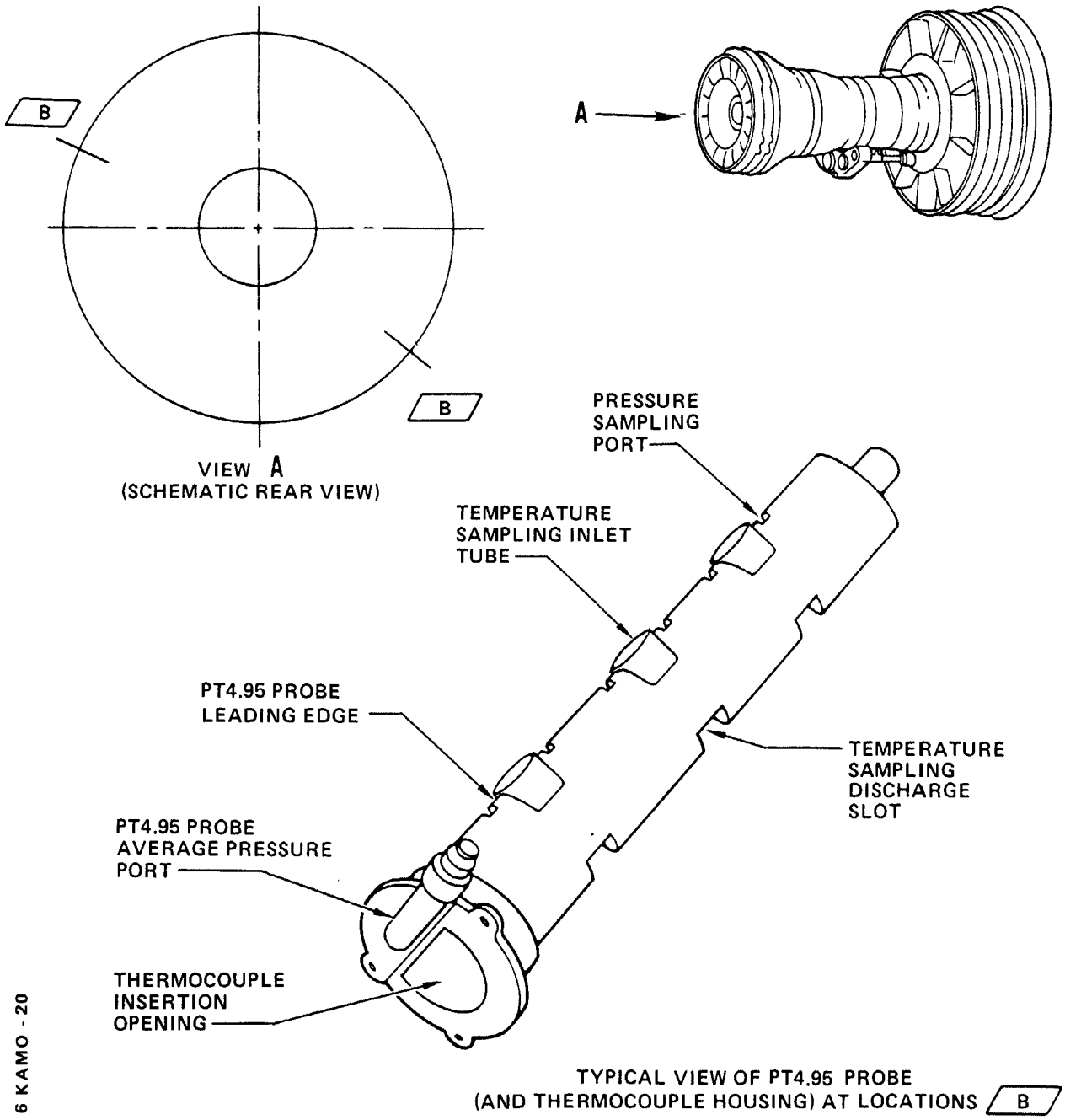
A. Job Set-Up
(1)Open, safety and tag the circuit breakers and open fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).
(2)Install access platform.
(3)Remove average pressure probe PT 4.95 (Ref. 77-15-01, P. Block 401).

B. Inspection (Ref. Fig. 601, 602)
(1)Inspect probe for nicks, dents, cracks and deformation.
(a)Nicks and dents are acceptable.
(b)Deformation due to heat is acceptable provided that assembly into the engine and thermocouple installation is not affected.
(c)Cracked probes should be rejected.
(2)Inspect probe pressure port for thread damage. Repair thread as required.
Pre SB PW4ENG 77-16
NOTE : The inspection steps that follow are not necessary for Post SB PW4ENG 77-16 parts.
(3)Inspect temperature sampling tubes and slots in leading edge of probe casting for obstructions to flowpath.
Line of sight flowpath to probe slots on leading edge of probe should be maintained.
(4)Six pressure sampling ports on leading edge of probes must be open to minimum of index 6 (Ref. Fig. 602). It is permissible to use a 0.030 in. (0.762mm) diameter hand-held drill to unplug holes.

(5)The temperature sensing slots on probe leading edge and surrounded by an inlet tube must be open to minimum width and length indexes 3 and 5 (Ref. Fig. 602) as viewed from the front.
(6)Three temperature sampling discharge slots on probe trailing edge should be open to minimum width and length indexes 2 and 1 (Ref. Fig. 602) as viewed from the rear.

C. Close-Up
(1)Install average pressure probe PT 4.95 (Ref. 77-15-01, P. Block 401).
(2)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(3)Remove access platform.
(4)Remove safety clips and tags and close circuit breakers. Close thrust

reverser and fan cowl doors (Ref. 71-13-00, P. Block 301).



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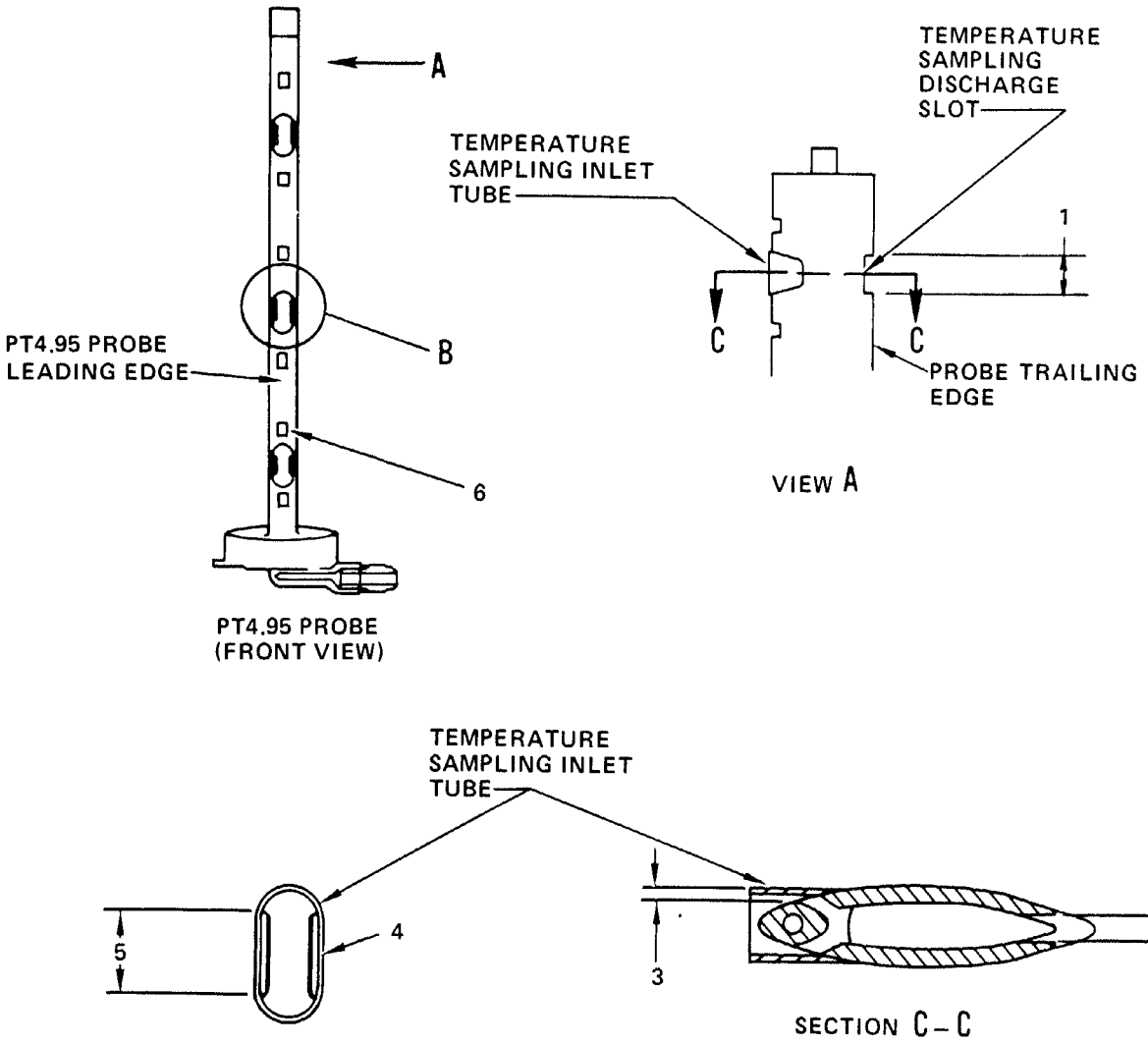
Exhaust Gas Average Pressure
(and Thermocouple Housing) PT 4.95 Probe
Figure 601



BM5 77 15 01 6 KCMO - 20

1. 0.700 In. (17.780mm) Minimum Slot Length
2. 0.160 In (4.064mm) Minimum Slot Width
3. 0.050 In (1.270mm) Minimum Slot Width
4. 80 Percent of Slot Should Be Visible If Viewed From The Front
5. 0.350 In. (8.890mm)Minimum Open Slot Length
6. Pressure Sampling Port. Open To 0.030 In. (0.762mm) Minimum Diameter.

L-A0724

Exhaust Gas Average Pressure
(and Thermocouple Housing) PT 4.95 Probe
Figure 602

EXHAUST GAS PRESSURE (PT4.95) MANIFOLD - REMOVAL/INSTALATION

1. Equipment and Materials

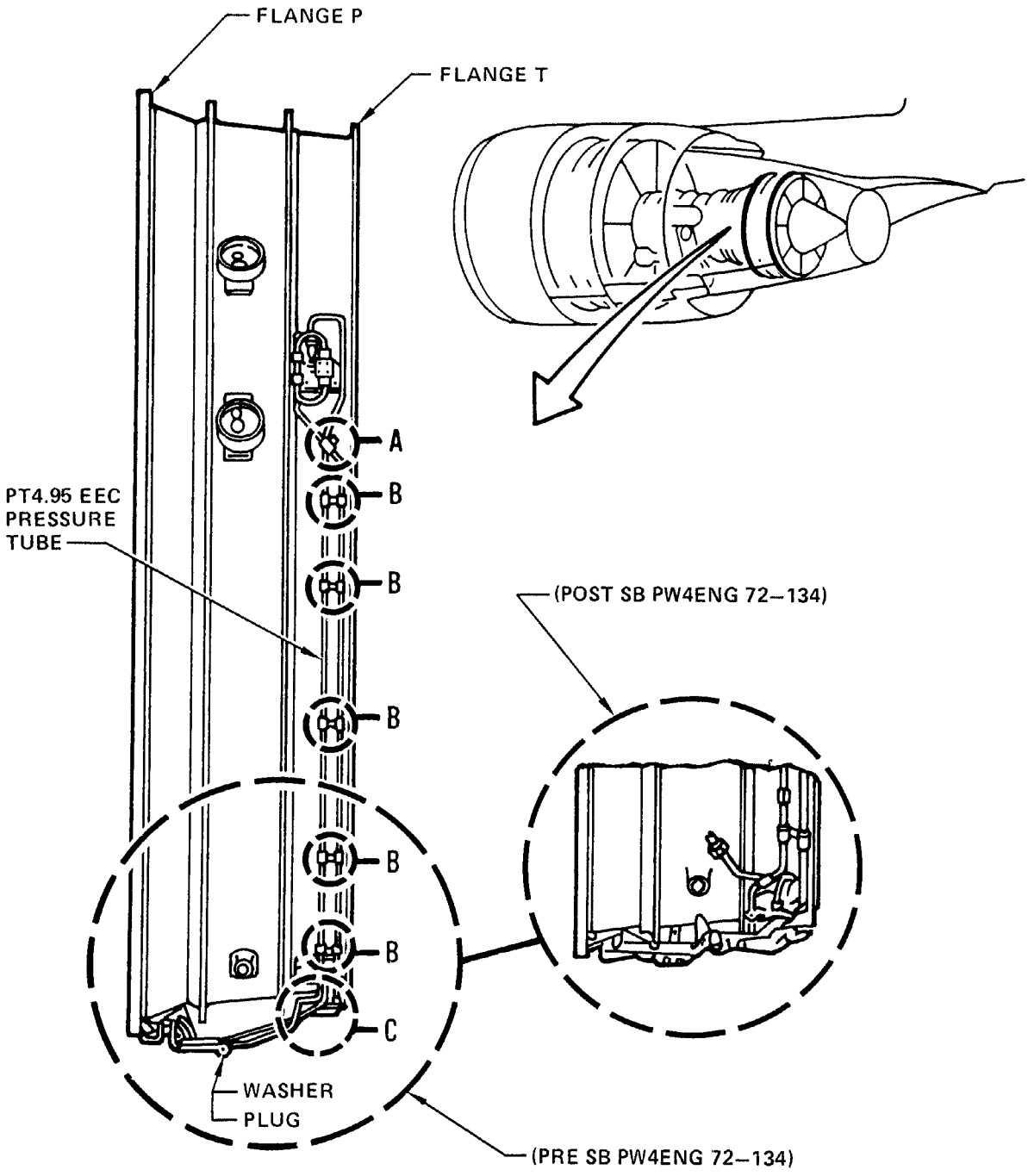
ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Access Platform
C.	Bergen Mechanical Crimper (Optional) Model M303, M305 or M307
D.	Torque Wrench
E. Material No.P03-001	Oils (Ref. 70-00-00)
F. Material No.P05-289	Special Materials (Ref. 70-00-00)
G. Material No.P05-291	Special Materials (Ref. 70-00-00)
H. Material No.P05-292	Special Materials (Ref. 70-00-00)
Referenced Procedures	
- 71-00-00, P. Block 501	Power Plant - General
- 71-13-00, P. Block 301	Cowl Doors
- 77-15-00, P. Block 501	Engine Pressure Ratio (EPR)

2. Procedure

A. Job Set-Up
(1)Open, safety and tag the appropriate circuit breakers and open thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).
(2)Install access platform.

B. Removal (Pre SB PW4 ENG 72-134) (Ref. Fig. 401)
(1)Remove lockwire or safety cable and disconnect manifold nuts from PT4.95 probes at approximately 4.30 o'clock and 10 o'clock positions on turbine exhaust case.
(2)Remove lockwire or safety cable, plug and washer from manifold tee at approximately 6 o'clock position rearward of Flange P.
(3)Remove lockwire or safety cable and disconnect tube nut from manifold tee.
(4)Remove bolt and nut securing TT4.95 cable to manifold at approximately 10 o'clock position.
(5)Remove bolts, nuts and clamps securing manifold to Flange T brackets.
(6)Rotate manifold counterclockwise (as viewed from rear) to remove manifold from above TT4.95 cables at 6 o'clock position. Rotate manifold again clockwise (as viewed from rear) to remove manifold from under TT4.95 cable at approximately 10 o'clock position.
(7)Remove manifold and install protective closures.

C. Installation (PRE SB PW4 ENG 72-134) (Ref. Fig. 401)
(1)Remove protective closures.
CAUTION : USE OF LUBRICANTS ON FADEC SENSING TUBES, ADAPTERS, OR PACKINGS COULD RESULT IN CONTAMINATION OF FADEC.
(2)Install manifold to turbine exhaust under TT4.95 cable at approximately 10 o'clock position. Rotate manifold clockwise (as viewed from rear) far enough to position opposite end above TT4.95



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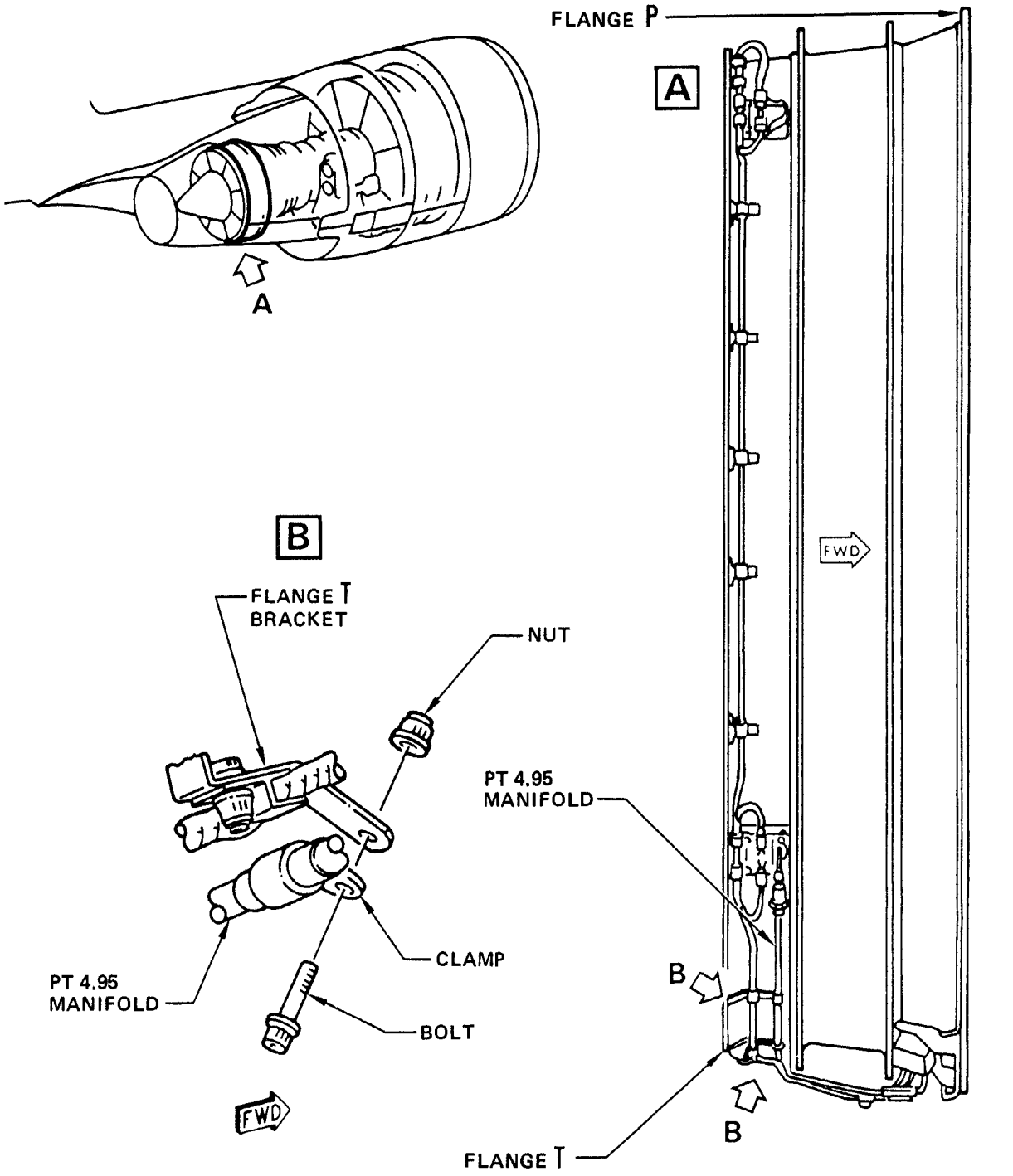
DM5

Exhaust Gas Pressure (PT4.95) Manifold (PRE SB PW4 ENG 72-134)
(Sheet 1/3)
Figure 401



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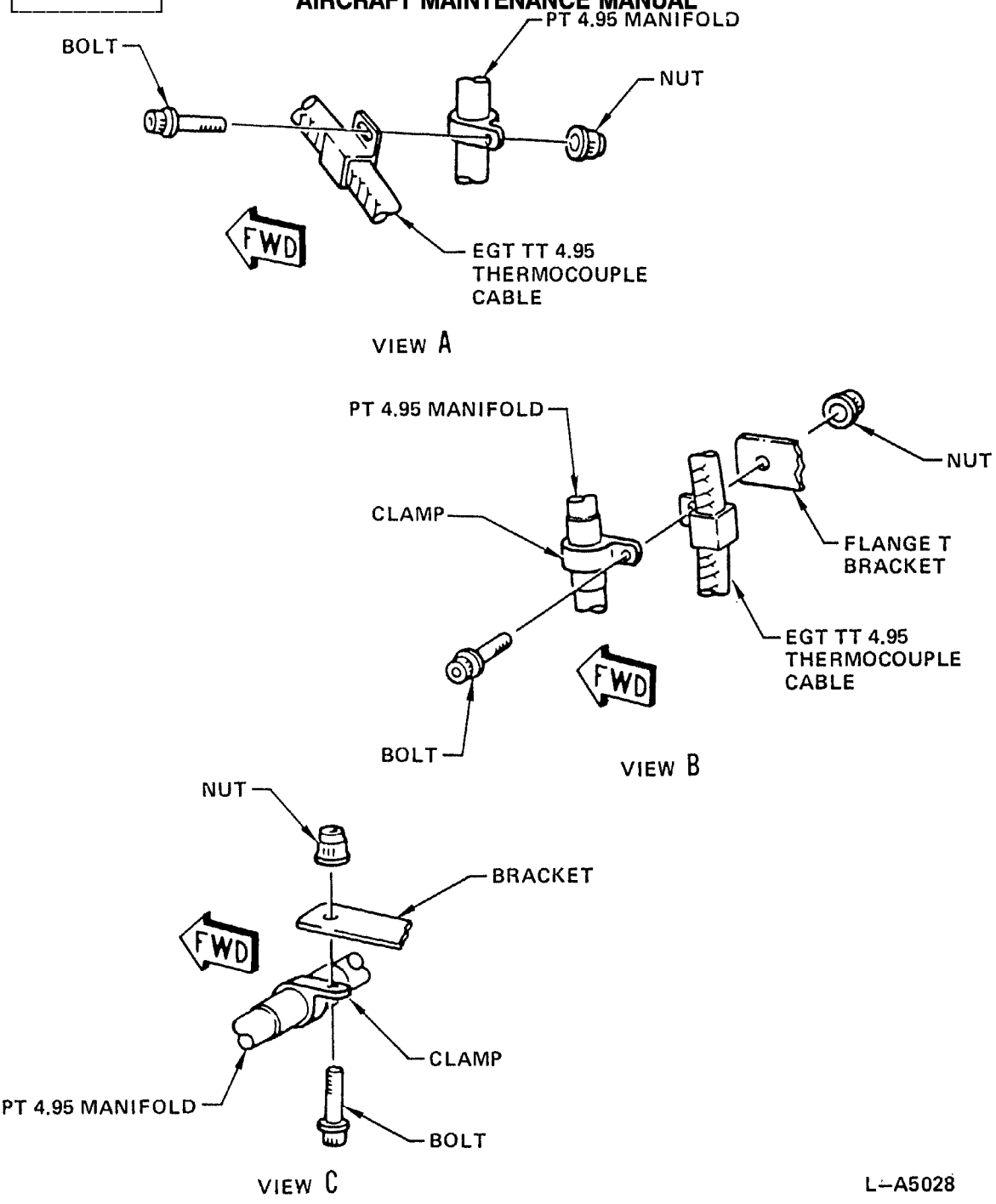
Exhaust Gas Pressure (PT4.95) Manifold (PRE SB PW4 ENG 72-134)
(Sheet 2/3)
Figure 401



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Exhaust Gas Pressure (PT4.95) Manifold (PRE SB PW4 ENG 72-134)
(Sheet 3/3)
Figure 401

cables at approximately 6 o'clock position. Rotate manifold again counterclockwise (as viewed from rear) to connect manifold nuts to PT4.95 probes. Connect PT4.95 tube to manifold tee at approximately 6 o'clock position handtight only.

(3)Install clamps, bolts, threads lubricated with Engine Oil (Material No.P03-001) and nuts. TORQUE clamp bolts to between 36 and 40 lbf.in. (0.41 and 0.45 m.daN).

(4)Secure TT4.95 cable to manifold at approximately 10 o'clock position with bolt, threads lubricated with Engine Oil (Material No.P03-001) and nut. TORQUE bolt to between 36 and 40 lbf.in. (0.41 and 0.45 m.daN).

(5)TORQUE manifold nuts to probes to between 135 and 150 lbf.in. (1.53 and 1.69 m.daN). Install the Lockwire (Material No.P05-289) or the Safety Cable (Material No.P05-291) and Safety Cable Ferrule (Material No.P05-292) to safety the manifold nuts.

(6)TORQUE tube nut to manifold tee at approximately 6 o'clock position to between 270 and 300 lbf.in. (3.06 and 3.38 m.daN). Install the Lockwire (Material No.P05-289) or the Safety Cable (Material No.P05-291) and Safety Cable Ferrule (Material No.P05-292) to safety the tube nut.

(7)Install washer and plug to tee and TORQUE plug to between 40 and 50 lbf.in. (0.46 and 0.56 m.daN). Install the Lockwire (Material No.P05-289) or the Safety Cable (Material No.P05-291) and Safety Cable Ferrule (Material No.P05-292) to safety the plug.

D. Removal (Post SB PW4 ENG 72-134) (Ref. Fig. 402)

(1)Remove the lockwire or safety cable and disconnect the tube nut (10) and manifold nut (9) from the probes at the 4:30 and 10:30 O'clock positions on the tubine exhaust case.

(2)Remove the lockwire or safety cable, plug (8) and washer (7) from the manifold (1).

(3)Remove the lockwire or safety cable and disconnect the manifold nut (5) from the tube coupling at the rear of Flange P. at approximately the 7 O'clock position.

(4)Remove the bolts, nuts and clamps from the manifolds and tube assembly. (Ref. Fig. 402)

(5)Remove the lockwire or safety cable and disconnect the manifold nut (6) and the tube nut (4) at the 6 and 8 O'clock positions.

(6)Remove the manifold assemblies (1) and (2) and the tube assembly (3) from the turbine exhaust case. Install protection covers to the manifolds and tube assemblies.

E. Installation (Post SB PW4 ENG 72-134) (Ref. Fig. 402)

(1)Remove the protection covers from the probe adpters, manifolds, and tube assembly.

CAUTION : DO NOT USE ANY LUBRICANTS ON THE EEC PT4.95 MANIFOLDS, TUBES, OR ADAPTERS. CONTAMINATION OF THE EEC CAN RESULT.

(2)Install the manifold assembly (1) onto the exhaust case and thread the manifold nut (9) onto the adapter of the PT 4:95 probe at the 4:30 O'clock position and tighten by hand.

(3)Install the manifold assembly (2) onto the exhaust case and thread the manifold nut (6) onto the manifold tee at the 6 O'clock position. Thread the manifold nut (5) onto the tube coupling of the rear PT4.95 EEC

tube assembly at the rear of Flange P at the 7 O'clock position. Tighten the manifold nuts by hand.

(4) Install the tube assembly (3) onto the exhaust case and thread the upper tube nut (10) onto the adapter of the probe at the 10 O'clock position. Thread the lower tube nut (4) onto the manifold coupling at the 8 O'clock position. Tighten the tube nuts by hand.

(5) Install clamps, bolts, threads lubricated with Engine Oil (Material No.P03-001), and nuts. TORQUE the clamp bolts to between 36 and 40 lbf.in. (0.41 and 0.45 m.daN). (Ref. Fig. 402).

(6) TORQUE the PT 4.95 EEC manifold nut (6) at the 6 O'clock position to between 270 and 300 lbf.in. (3.06 and 3.38 m.daN). Install the Lockwire (Material No.P05-289) or the Safety Cable (Material No.P05-291) and Safety Cable Ferrule (Material No.P05-292) to safety the manifold nut.

(7) TORQUE the PT 4.95 EEC tube nut (4) at the 8 O'clock position to between 135 and 150 lbf.in. (1.53 and 1.69 m.daN). Install the Lockwire (Material No.P05-289) or the Safety Cable (Material No.P05-291) and Safety Cable Ferrule (Material No.P05-292) to safety the tube nut.

(8) TORQUE the manifold nut (9) and tube nut (10) to the probe adapters to between 135 and 150 lbf.in. (1.53 and 1.69 m.daN). Install the Lockwire (Material No.P05-289) or the Safety Cable (Material No.P05-291) and Safety Cable Ferrule (Material No.P05-292) to safety the manifold nut.

(9) TORQUE the manifold nut (5) at the rear of Flange P at 7 O'clock position to between 270 and 300 lbf.in. (3.06 and 3.38 m.daN). Install the Lockwire (Material No.P05-289) or the Safety Cable (Material No.P05-291) and Safety Cable Ferrule (Material No.P05-292) to safety the manifold nut.

(10) Install the washer (7) and plug (9) into to manifold tee. TORQUE the plug to between 40 and 50 lbf.in. (0.46 and 0.56 m.daN). Install the Lockwire (Material No.P05-289) or the Safety Cable (Material No.P05-291) and Safety Cable Ferrule (Material No.P05-292) to safety the plug.

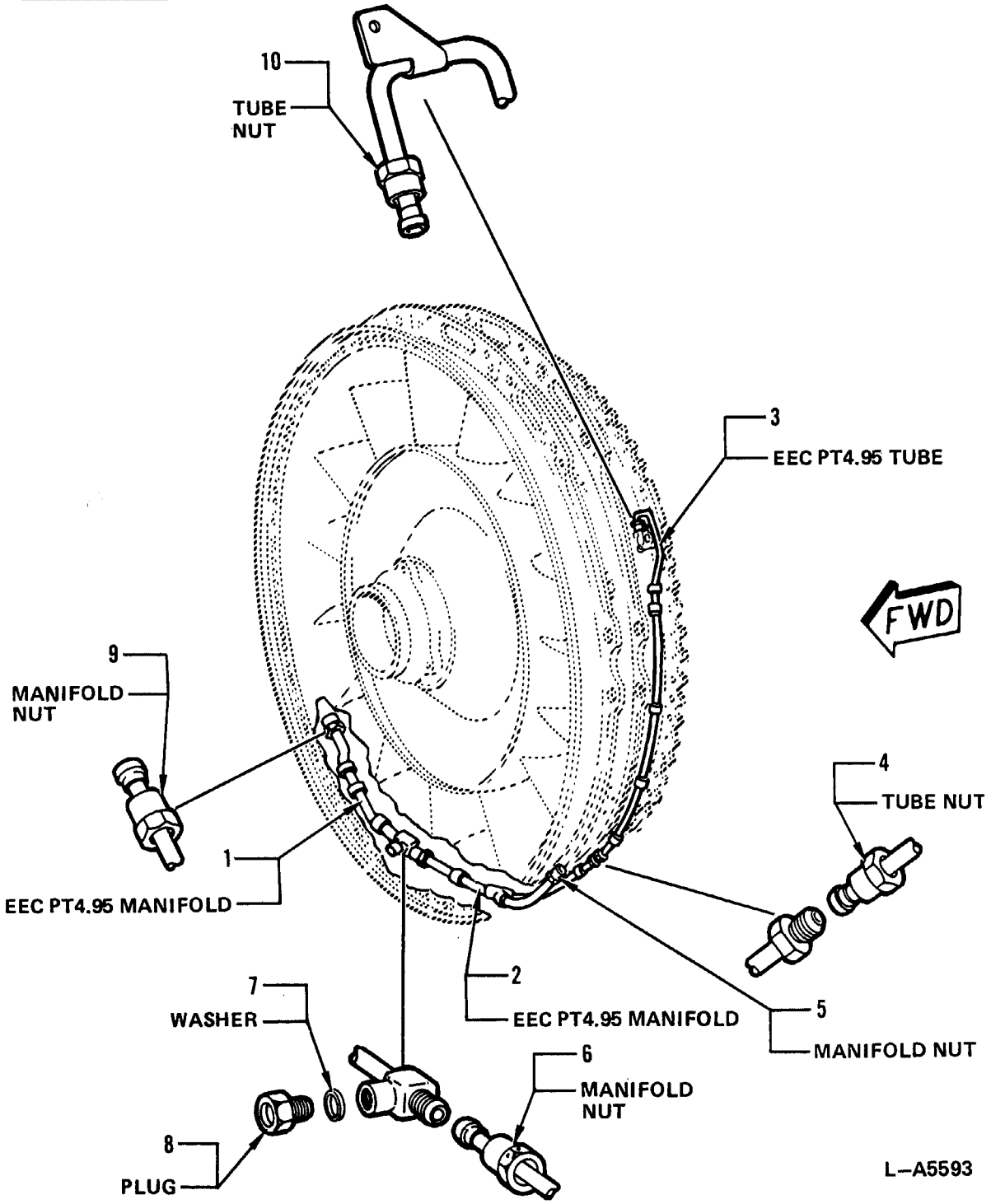
F. Close-Up and Test

(1) Make certain that working area is clean and clear of tools and miscellaneous items of equipment.

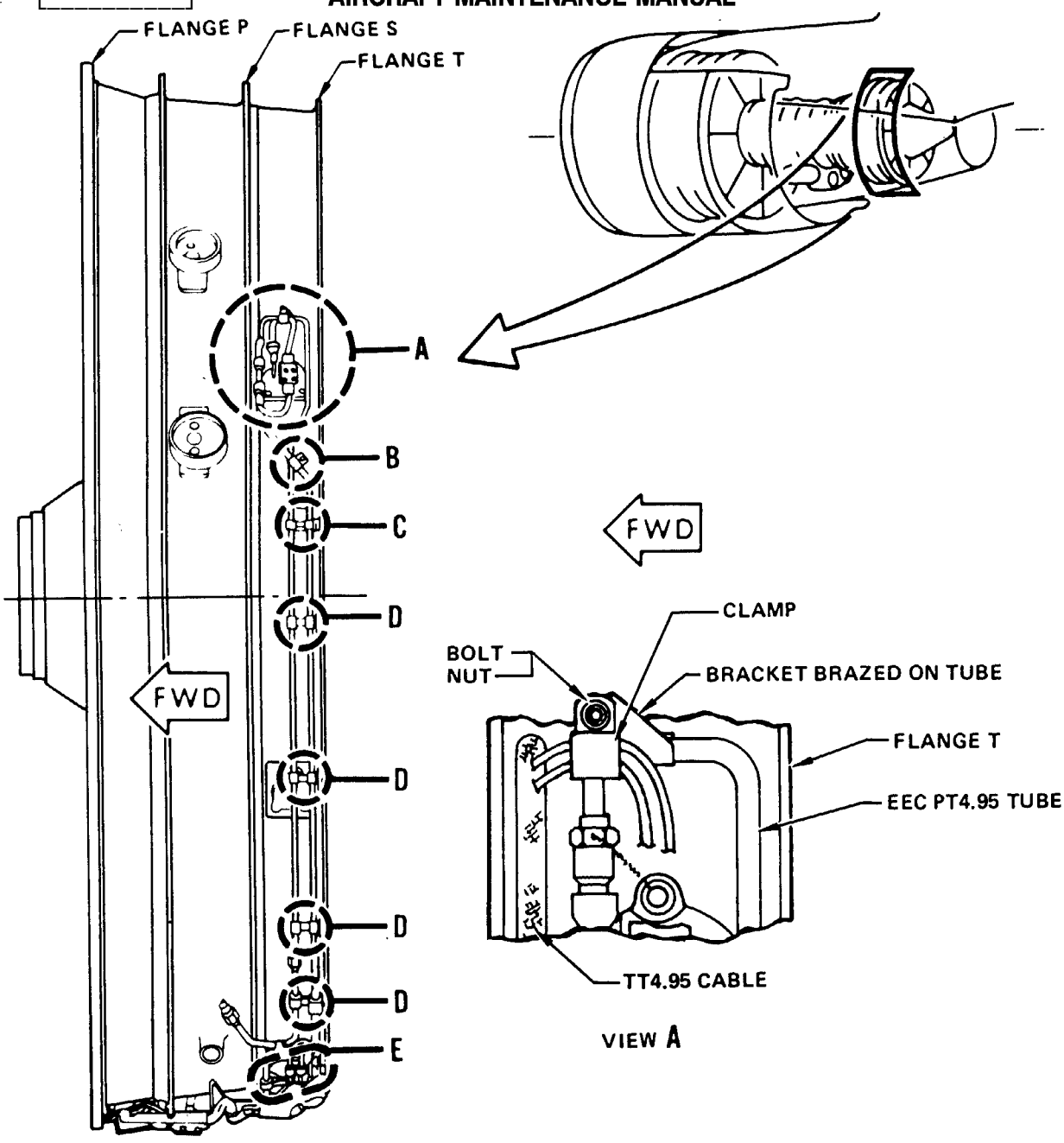
(2) Do a leak test of the EPR P4.95 System (Ref. 77-15-00, P. Block 501).

(3) Remove access platform.

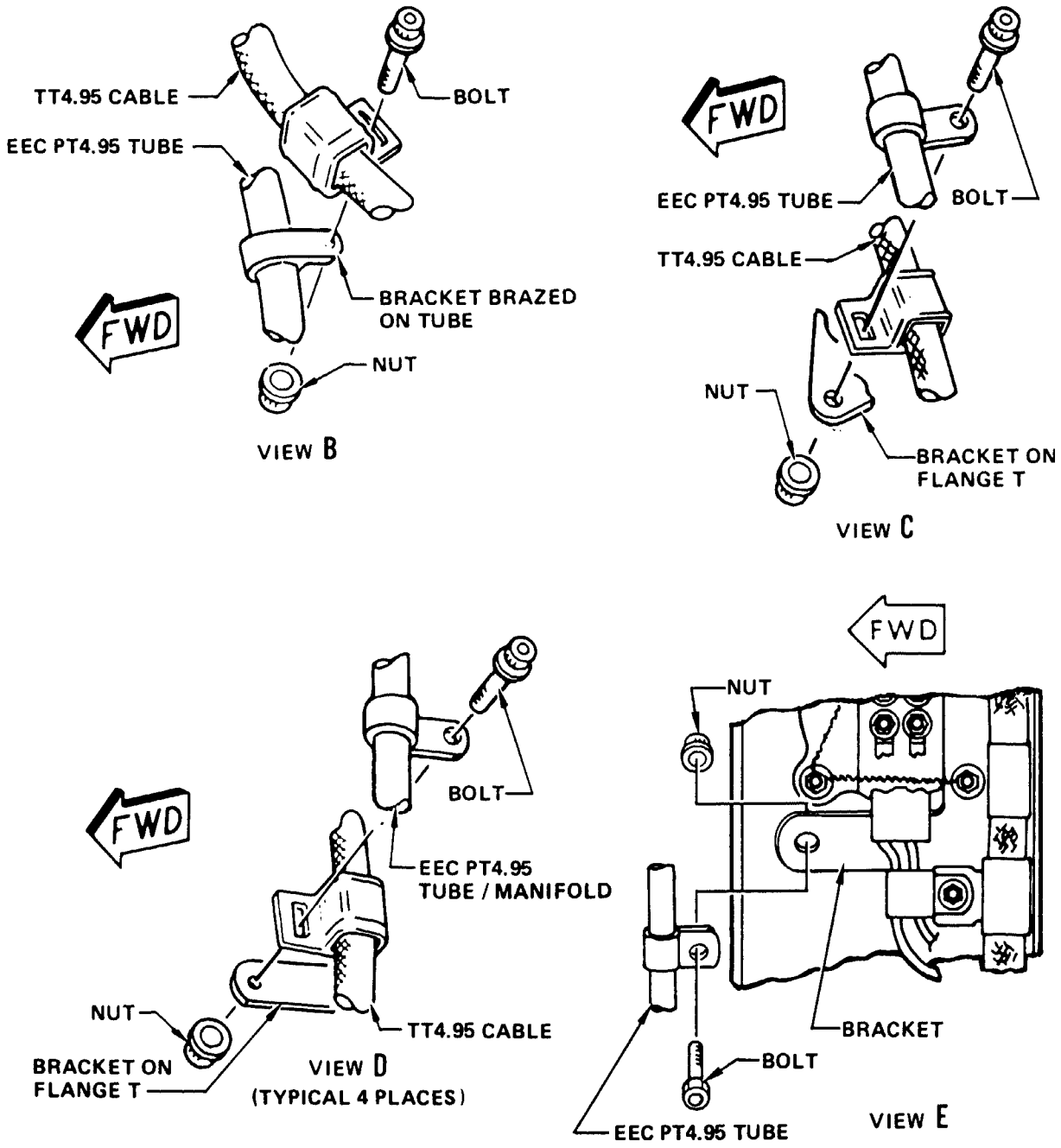
(4) Close thrust reverser and fan cowl doors, remove safety clips and tags and close circuit breakers. (Ref. 71-13-00, P. Block 301).



Exhaust Gas Pressure (PT 4.95) Manifold (Post SB PW4 ENG 72-134)
(Sheet 1/4)
Figure 402



Exhaust Gas Pressure (PT 4.95) Manifold (Post SB PW4 ENG 72-134)
(Sheet 2/4)
Figure 402



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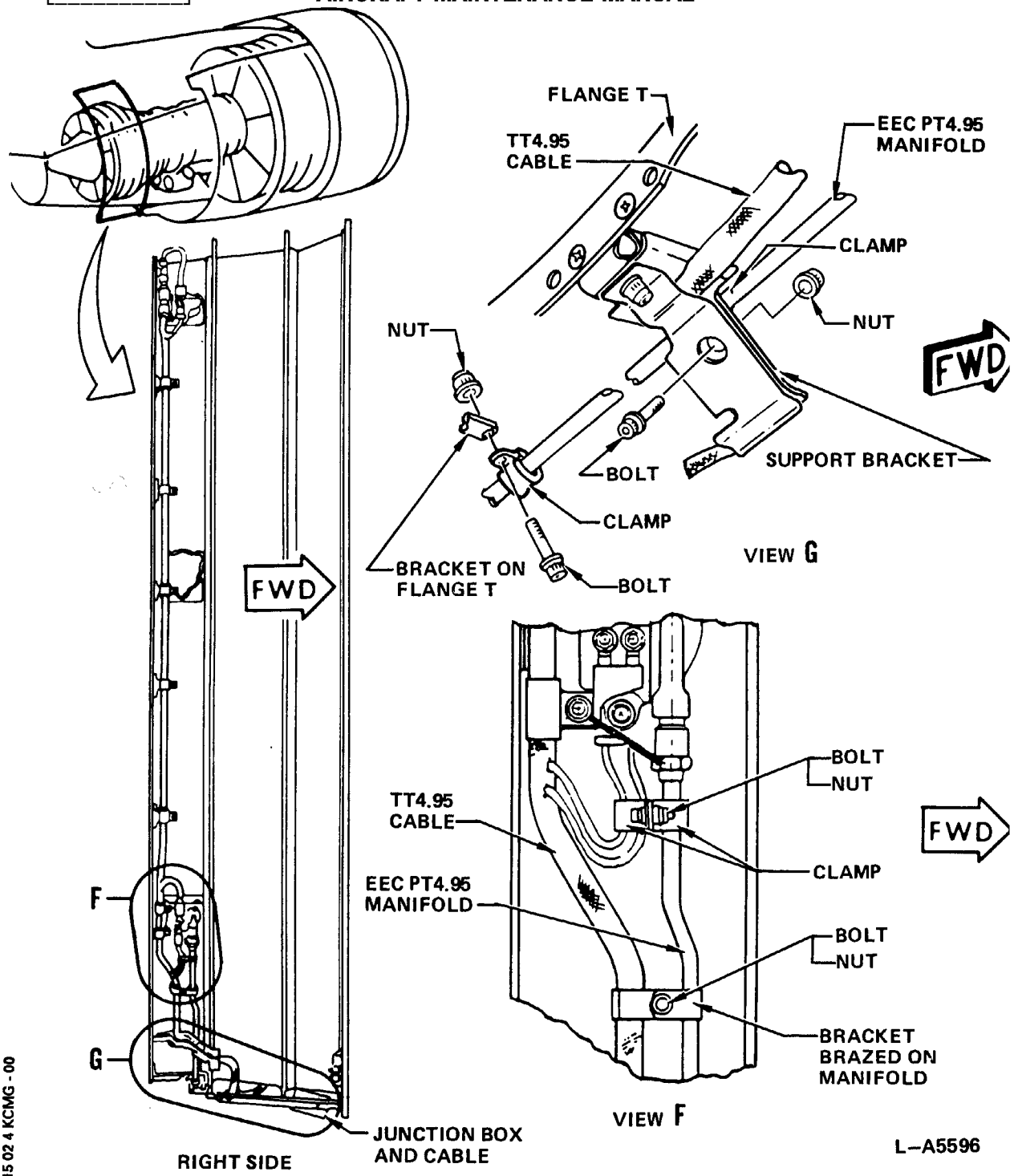
Exhaust Gas Pressure (PT 4.95) Manifold (Post SB PW4 ENG 72-134)
(Sheet 3/4)
Figure 402



Exhaust Gas Pressure (PT 4.95) Manifold (Post SB PW4 ENG 72-134)
(Sheet 4/4)
Figure 402

EPR INDICATOR - REMOVAL/INSTALLATION

NOTE : Removal/Installation procedures for EPR indicators on L and R engines are identical.

1. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Blanking Caps/Plugs
Referenced Procedure - 24-41-00, P. Block 301	AC External Power Control

2. Procedure

A. Job Set-Up

(1)Open, safety and tag the following circuit breakers :

PANEL	SERVICE	IDENT.	LOCATION
22VU	EPR ENG1	1EG	207/C15
22VU	EPR ENG1	2EG	207/C16

B. Removal

(Ref. Fig. 401)

(1)On face of panel 4VU, remove two screws (1) attaching EPR indicator.
(2)Remove EPR indicator (3) from panel 4VU.
(3)Disconnect EPR indicator and blank off plug and receptacle (2).

C. Installation

(1)Check housing of EPR indicator on panel 4VU.
(2)Remove blanking caps from plug and receptacle (2) and connect plug.
(3)Install EPR indicator (3) in panel 4VU.
(4)Attach EPR indicator (3) to panel 4VU with two screws (1).
(5)Remove safety clips and tags and close circuit breakers 1EG and 2EG.

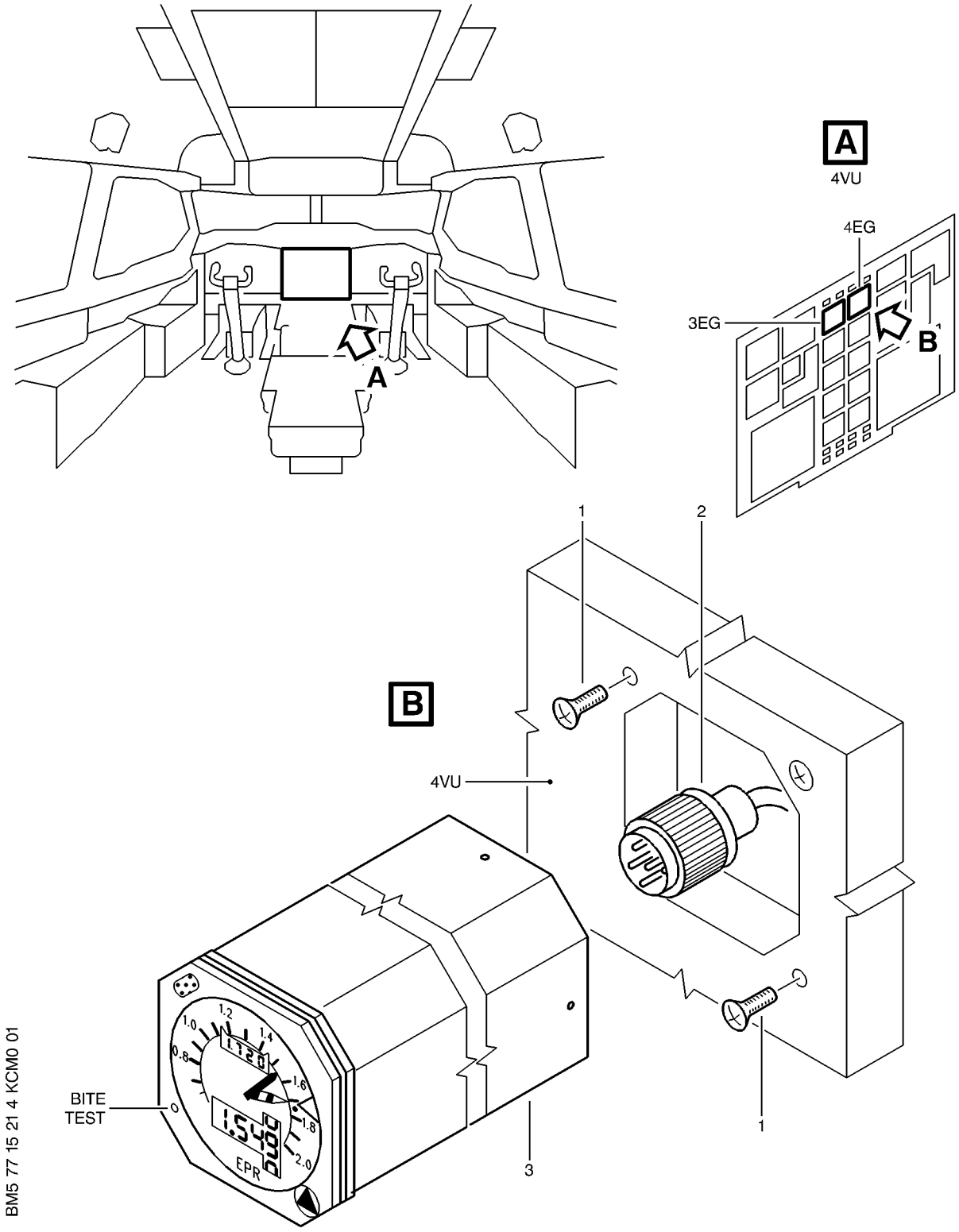
D. Test

(1)Connect electrical ground power unit (Ref. 24-41-00, P. Block 301).
(2)Make certain that electrical supply is correct (115VAC, 28VDC, 26VAC).

ACTION	RESULT
(1)On panel 4VU - maintain slot of BITE screw R or Press-To-Test button, located in L lower section of EPR R indicator 3EG (4EG) or pressed R in, respectively.	On EPR indicator 3EG (4EG) - the actual, command pointers and index indicate 1.75 ± 0.014 (actual, command pointers and index align with the blue dot). - the digital counter indicates 1.75 ± 0.02.
R - release BITE screw or release R Press-To-Test button.	- the actual, command pointers and index return to their original

ACTION	RESULT
	indications.

E. Close-Up
(1)De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, P. Block 301).
(2)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(3)Restore aircraft systems to normal operating condition.



EPR Indicator
Figure 401

R

EXHAUST GAS TEMPERATURE INDICATING SYSTEM - DESCRIPTION AND OPERATION

1. General

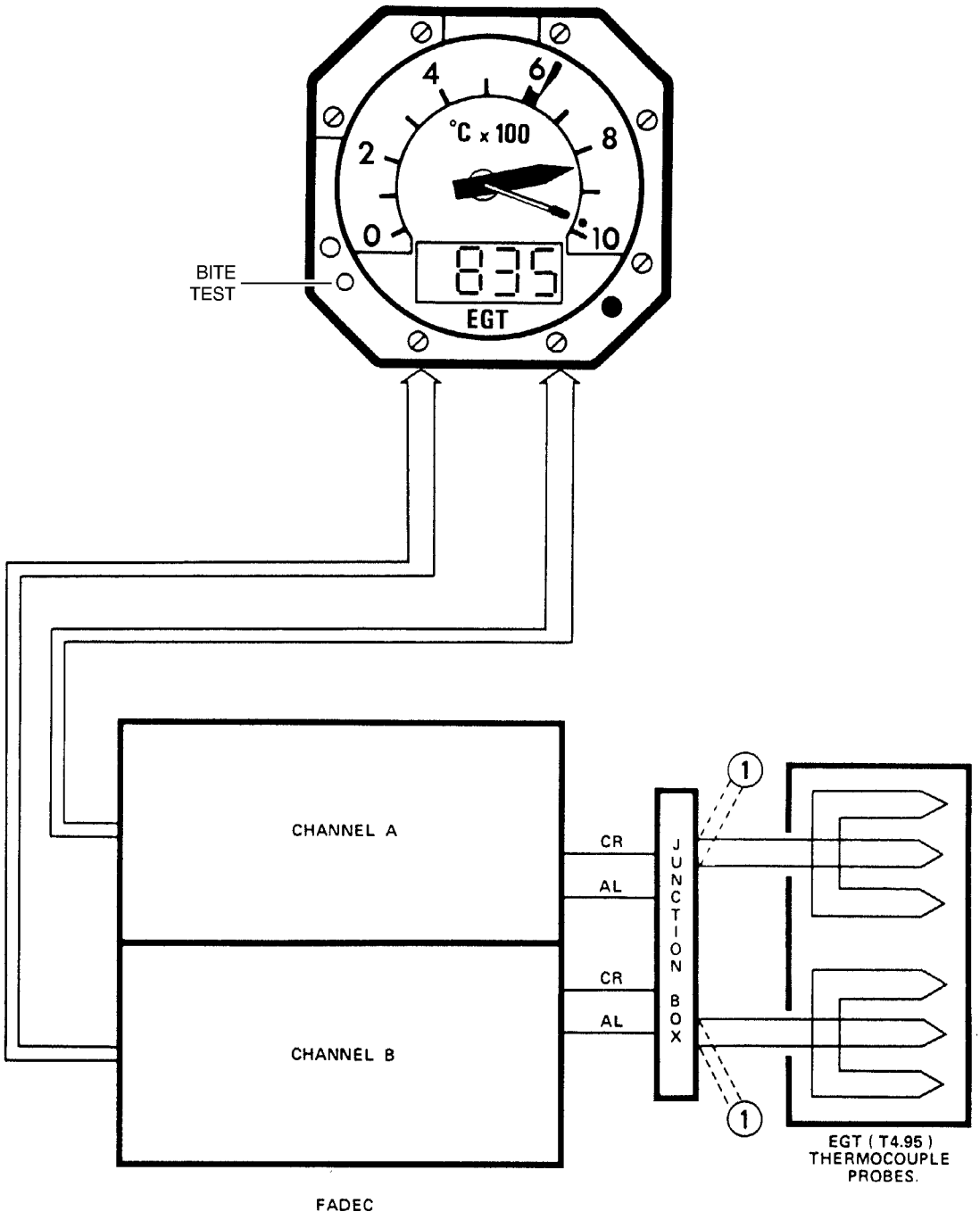
**ON A/C 101-200,

Post SB 72-2032 For A/C 101-200,

(Ref. Fig. 001)

**ON A/C 101-200,

(Ref. Fig. 002)
The exhaust gas temperature (EGT) indicating system provides a means of monitoring the operating temperatures and temperature limits of the gaspath at the LP turbine exhaust case. Four TT4.95 (EGT) probes are installed at the 1, 4, 7 and 10 o'clock positions on the turbine exhaust case. Readings from the thermocouple probes are collected at a common junction box, and averaged. The averaged signals are provided to the FADEC on channel A and B by thermocouple cables.
These signals are processed by the FADEC (channel A and b) to give a digital data bus signal proportional to the EGT (label 345) to be transmitted to the EGT indicator. The EGT indicator receives the signal on two ARINC bus input ports.
Logic is implemented to select the source of information (Ref. Fig. 003)
- when all the signal sources are available and valid from the both FADEC channels (A and B) : the logic selects the information coming from the channel in control.
- in case of failure of one signal : the logic selects the remaining valid information in order to keep the indication to the crew as long as possible.



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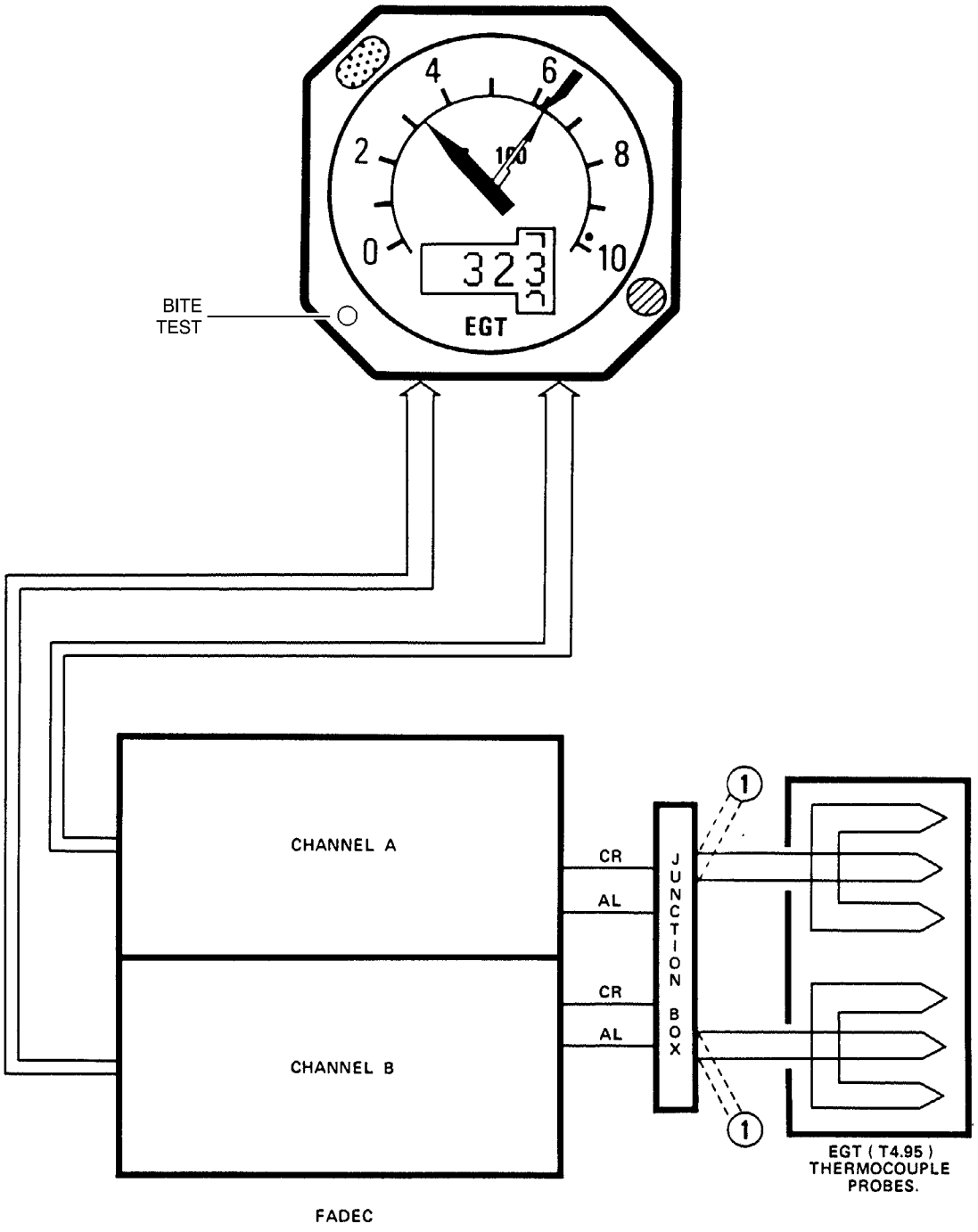
EGT Indication
Figure 001

R



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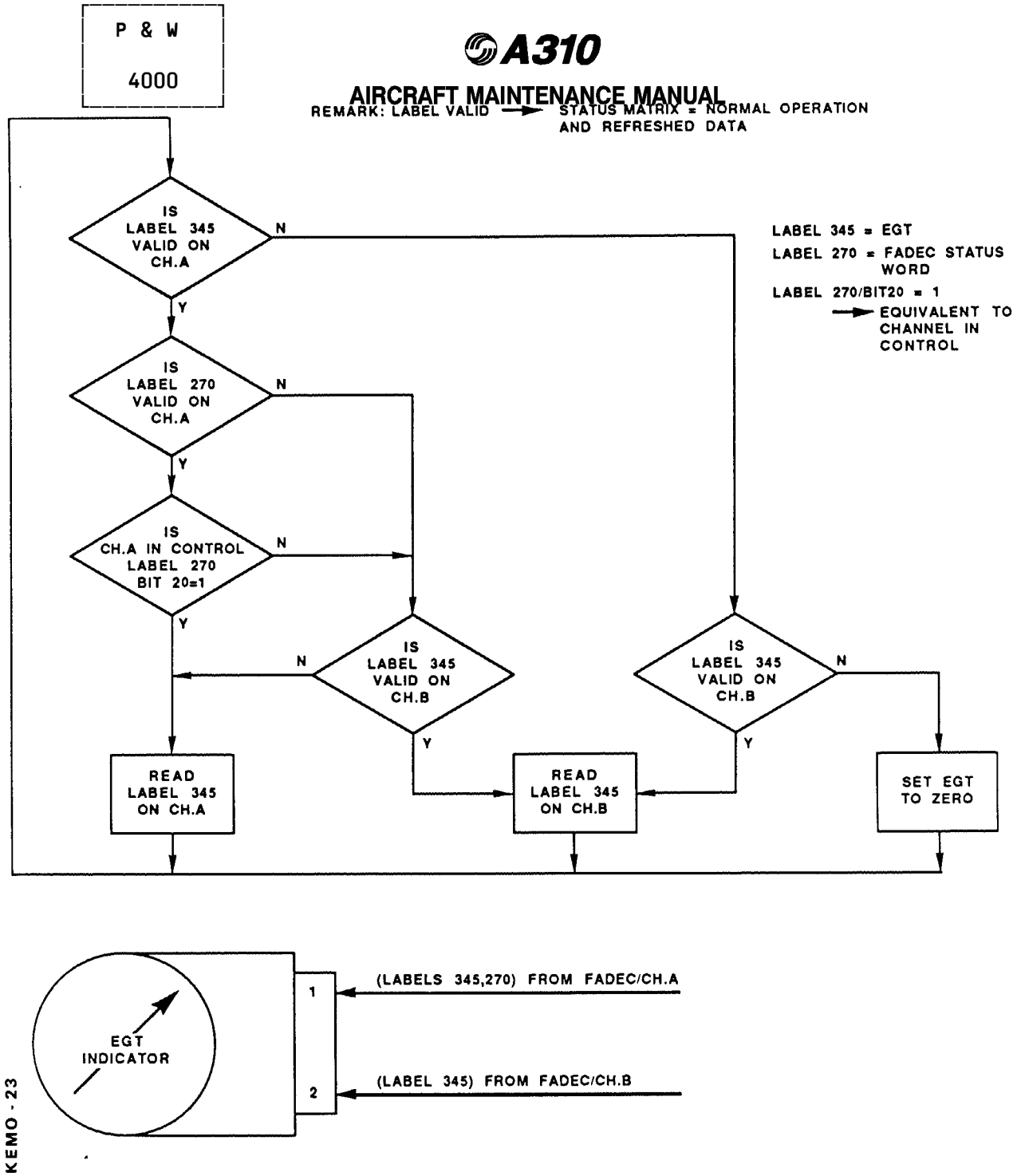
EGT Indication
Figure 002

R



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EGT: LABEL 345

EGT Indicator Selection logic
Figure 003

2. Component Location

**ON A/C 101-200,

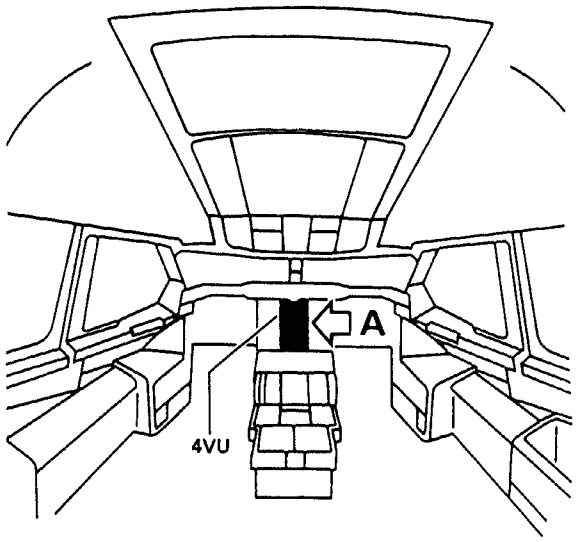
Post SB 72-2032 For A/C 101-200,

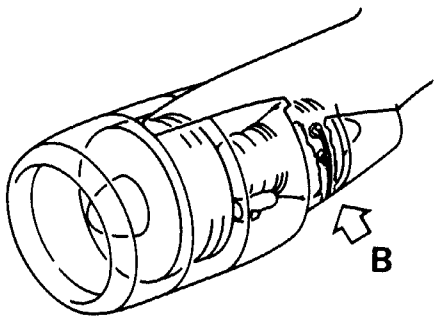
(Ref. Fig. 004)

**ON A/C 101-200,

(Ref. Fig. 005)

FIN	FUNCTIONAL DESIGNATION	PANEL	ZONE	ACCESS DOOR	ATA REF.
3EY	INDICATOR - EGT		211		77-21-00
4EY	INDICATOR - EGT		212		77-21-00
	BOX AND CABLE - EGT THERMOCOUPLE		456	452AR	77-21-03
			466	462AR	77-21-03
	THERMOCOUPLE - (TT 4.95)EGT		455	451AL	77-21-04
			456	452AR	77-21-04
			465	461AL	77-21-04
			466	462AR	77-21-04



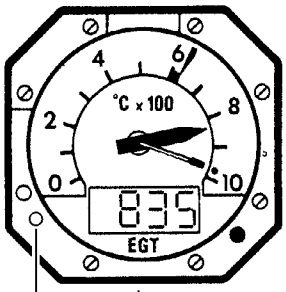


B

THERMOCOUPLE (TT 4,95) EGT

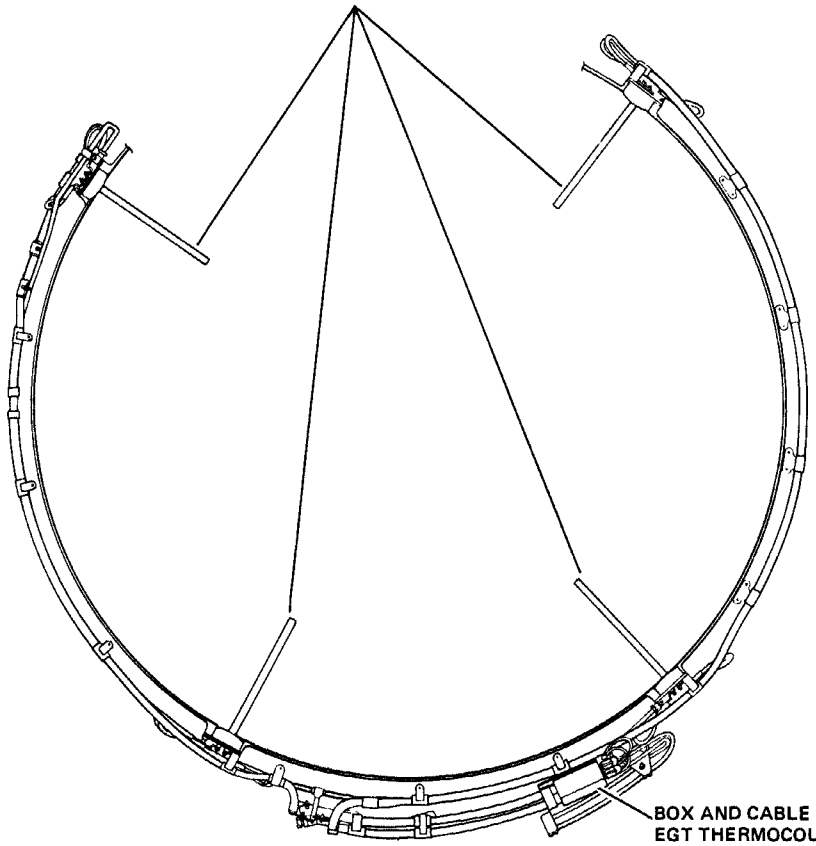
A

INDICATOR EGT



BITE TEST

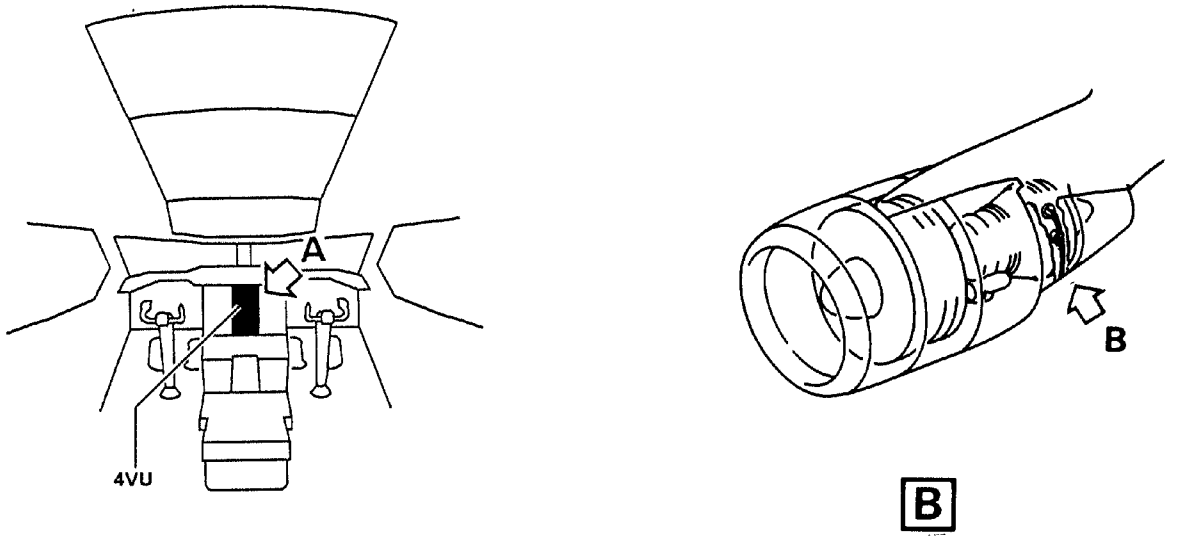
3EY
4EY

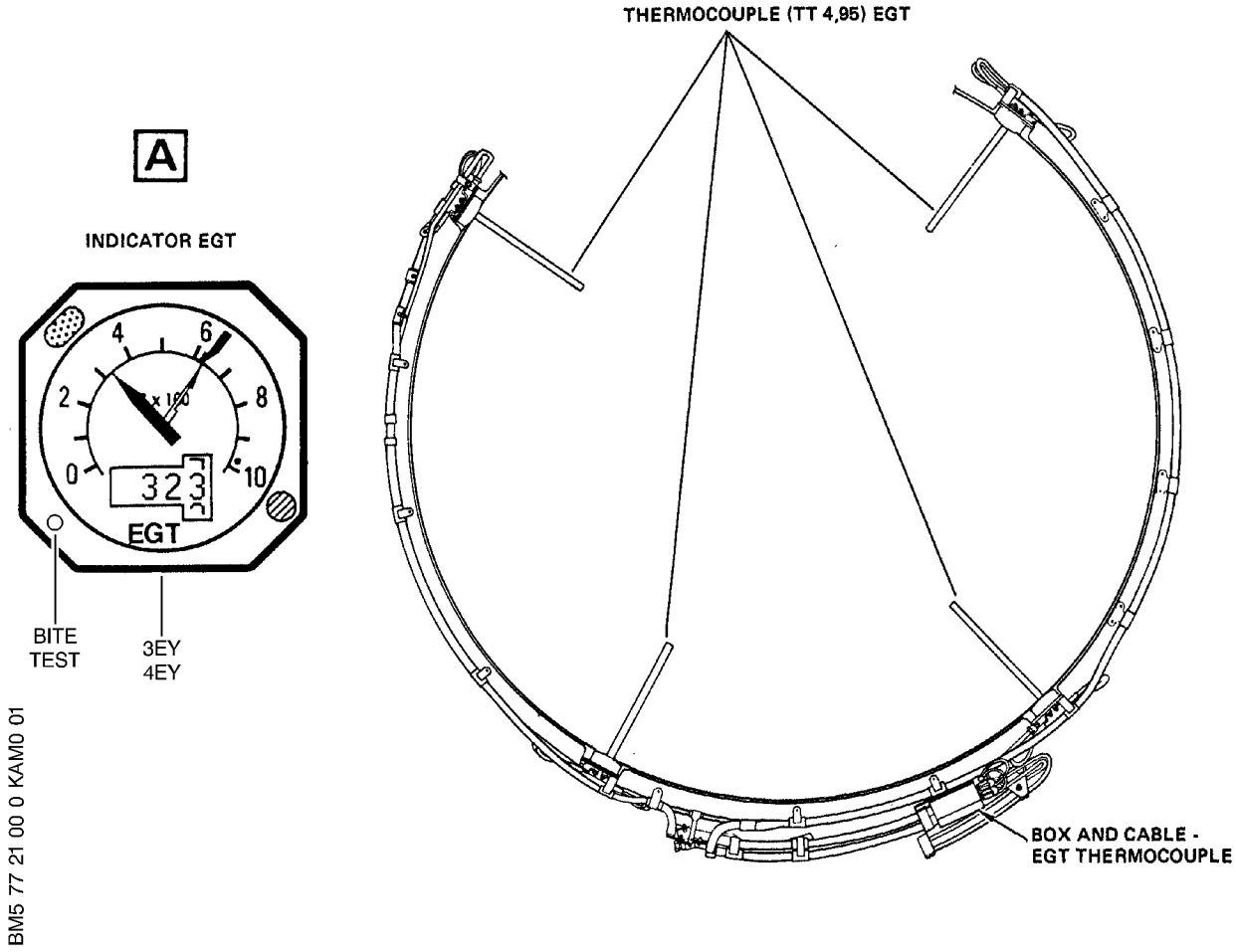


BM5 77 21 00 0 KAL0 01

Exhaust Gas Temperature Indicating System -
Component Location
Figure 004

R





Exhaust Gas Temperature Indicating System - Component Location
Figure 005

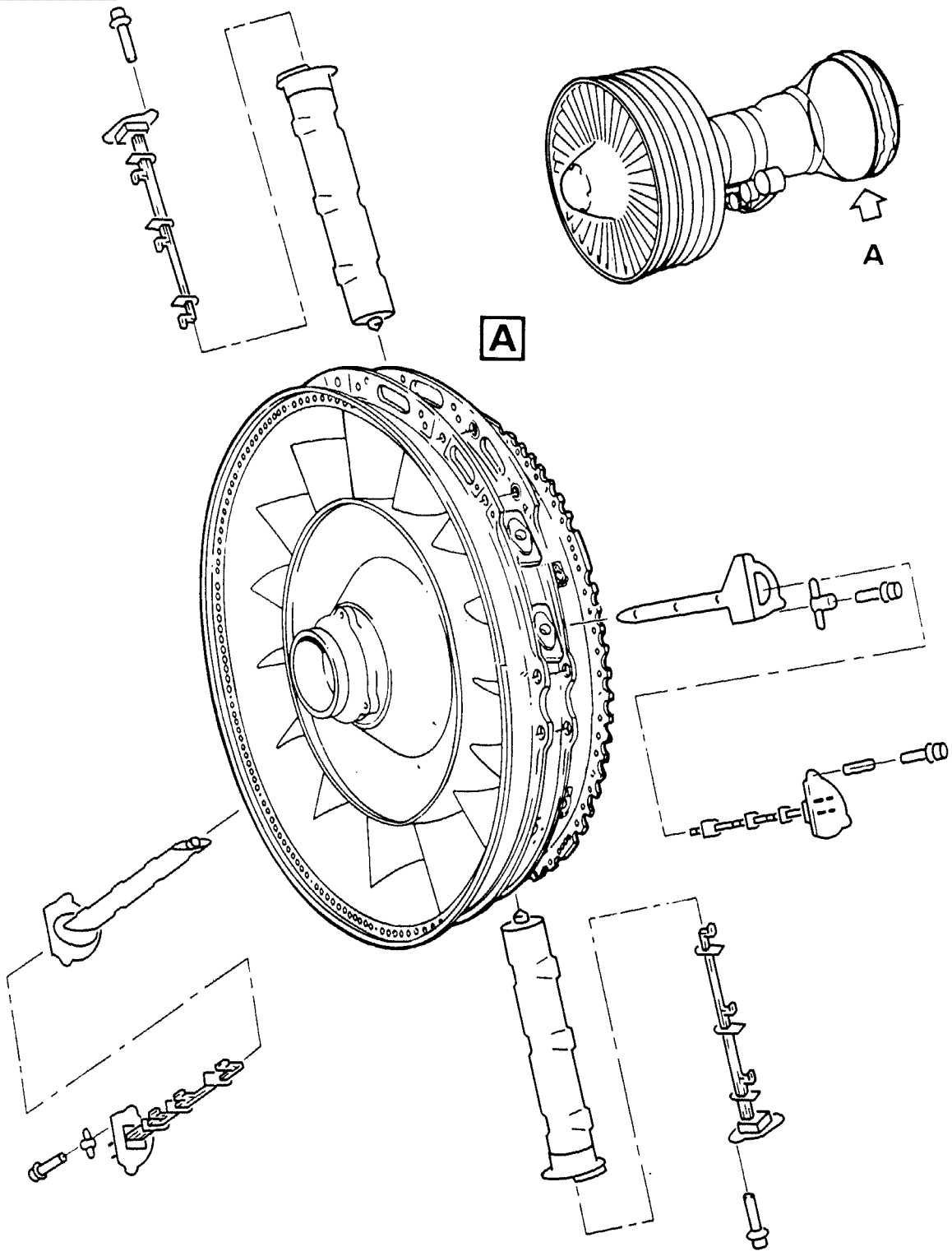
R

3. Thermocouple and Junction Box (Ref. Fig. 006)

The TT4.95 harness and junction box electrically average the two signals from each of the four probes. The junction box provides two electrically independent average output signals. Each signal is the probe average of three thermocouple elements from each of the four probes.

Each probe contains six separate chromel/alumel thermocouple elements which are located in three different engine radial positions. Three thermocouple elements are electrically averaged within the head of the probe and connected to a chromel stud and an alumel stud. The other three thermocouple elements are similarly averaged and connected to a second chromel/alumel stud pair.

The EGT (TT4.95) thermocouple box and cable assembly consists of two flexible harness assemblies which terminate in a four stud junction box. Each assembly is assembled with a stainless steel overbraid for abrasion protection and a copper alloy braid to protect the FADEC from electro magnetic interference (EMI) and lightning. The cable is positioned around the outer circumference of the turbine exhaust case, with a branch of the harness attached to each thermocouple stud.



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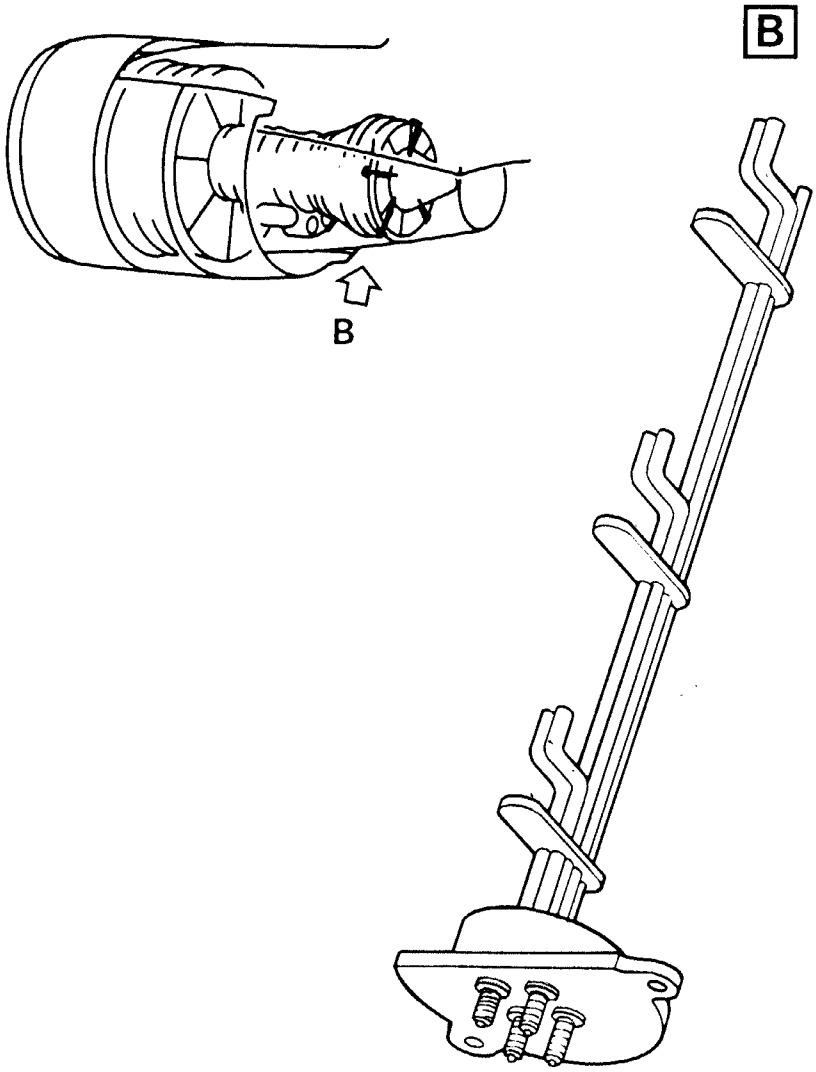
Thermocouples - Exhaust Gas Temperature T4.95 (Sheet 1/3)
Figure 006



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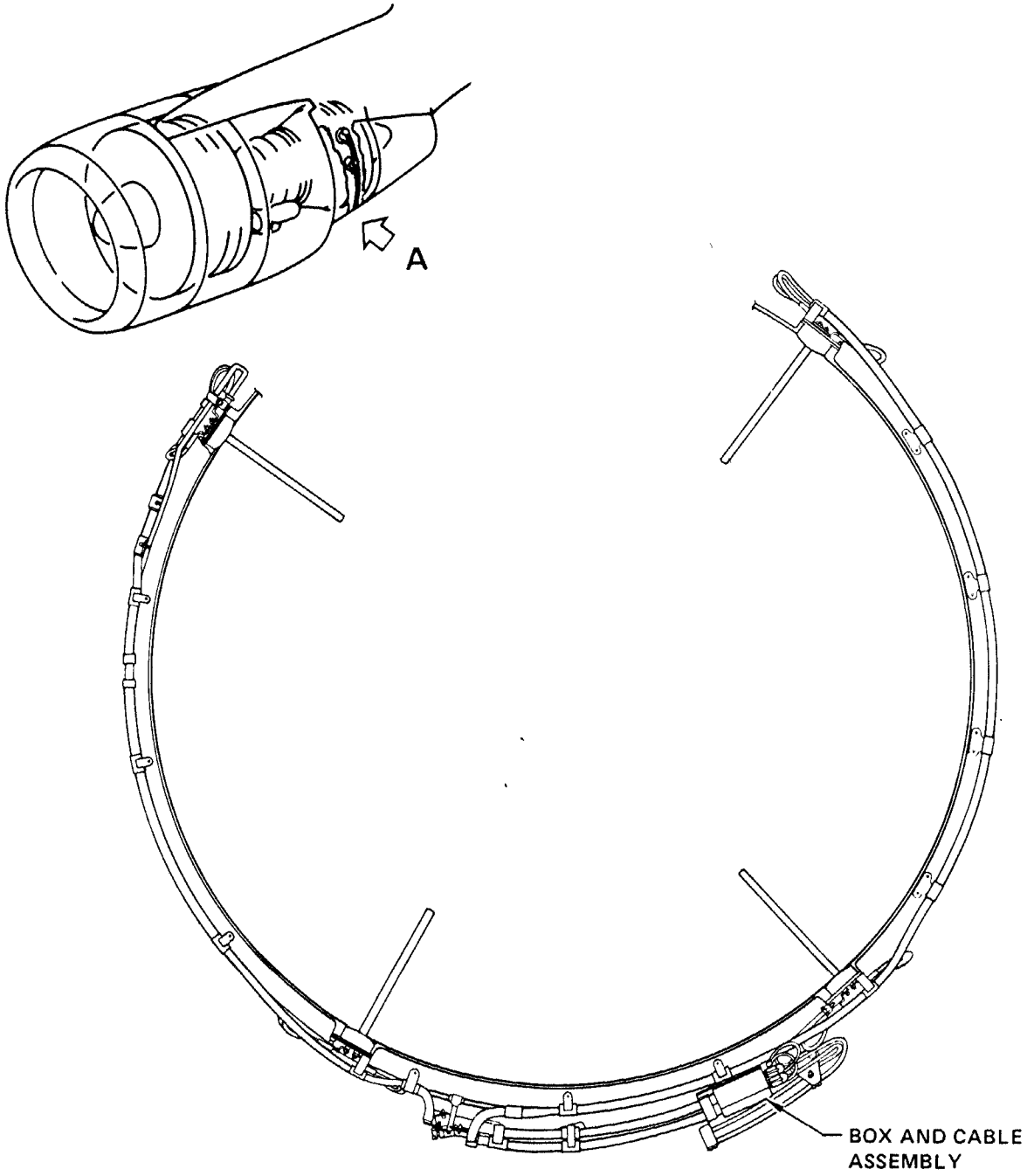
Thermocouples - Exhaust Gas Temperature T4.95 (Sheet 2/3)
Figure 006



VIEW IN DIRECTION A

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Box and Cable - Exhaust Gas Temperature T4.95 (Sheet 3/3)
Figure 006

4. EGT Indicator
(Ref. Fig. 007)

**ON A/C 101-104,

Post SB 72-2032 For A/C 101-104,

(Ref. Fig. 008)

**ON A/C 101-200,

The EGT indicator is located on the main instrument panel. It receives the digital signal from the FADEC channel A and B bus (label 345). This signal is processed by the indicator to be displayed in both digital (counter) and analog (pointer) formats within a scale ranging from 0 to 1000°C. An overtemperature pointer is set at a temperature of 625°C (red line value). Inside the indicator, a comparison switch is set to this limit temperature.

**ON A/C 101-104,

Post SB 72-2032 For A/C 101-104,

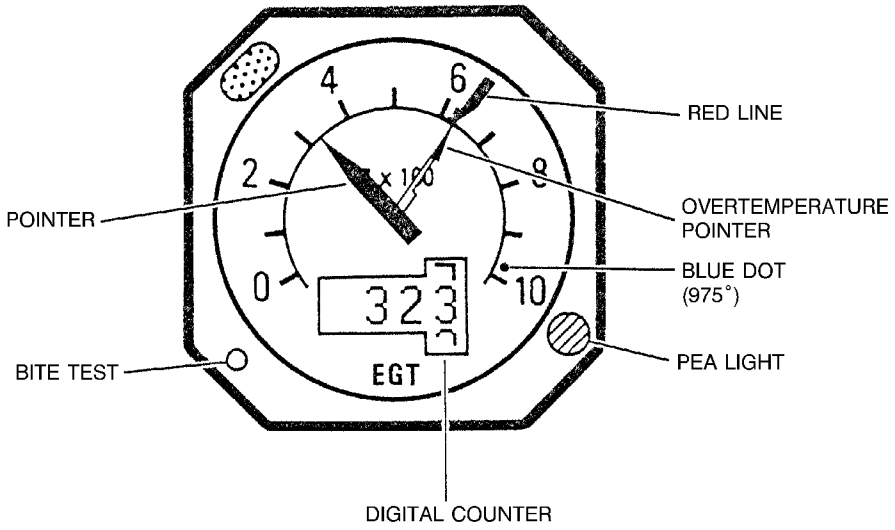
The EGT indicator is located on the main instrument panel. It receives the digital signal from the FADEC channel A and B bus (label 345). This signal is processed by the indicator to be displayed in both digital (counter) and analog (pointer) formats within a scale ranging from 0 to 1000°C. An overtemperature pointer is set at a temperature of 650°C (red line value). Inside the indicator, a comparison switch is set to this limit temperature.

**ON A/C 101-200,

The switch causes an amber light located on the lower left hand corner of the indicator to come on. It also activates the corresponding MASTER CAUTION lights, and the engine message on the ECAM display unit.
When MAX POINTER RESET pushbutton switch is activated the overtemperature pointer comes back.

A. Indicator Test
(Ref. Fig. 009)

R (1)A BITE test is provided on the lower left corner of the indicator. When the indicator is operating normally and BITE is selected by turning and
R maintaining the bite test :
- the LED matrix display sequentially indicates : ROM, µP, A/D, I/P and then the numeric value of the "blue dot" mark (975°C +/- 10°C)
- the EGT pointer and "OVERTEMPERATURE pointer" go to the "blue dot" mark on the dial.
- the amber light on the lower right corner of the indicator comes on.
- a message appears on the left ECAM DU associated with a MASTER CAUTION and SINGLE CHIME.



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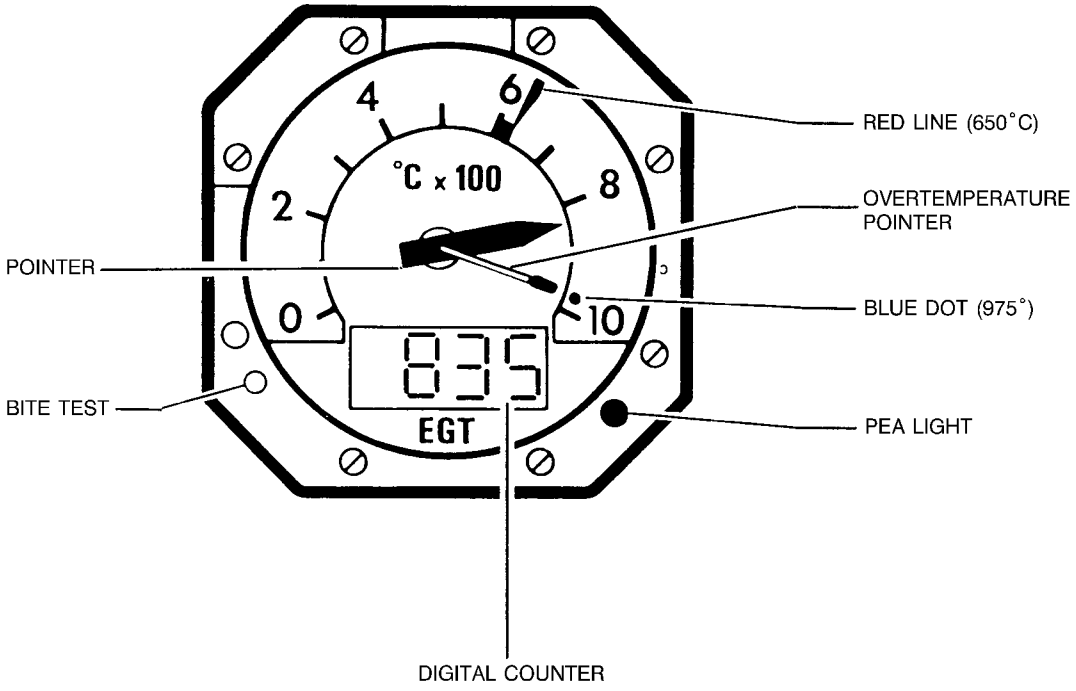
R

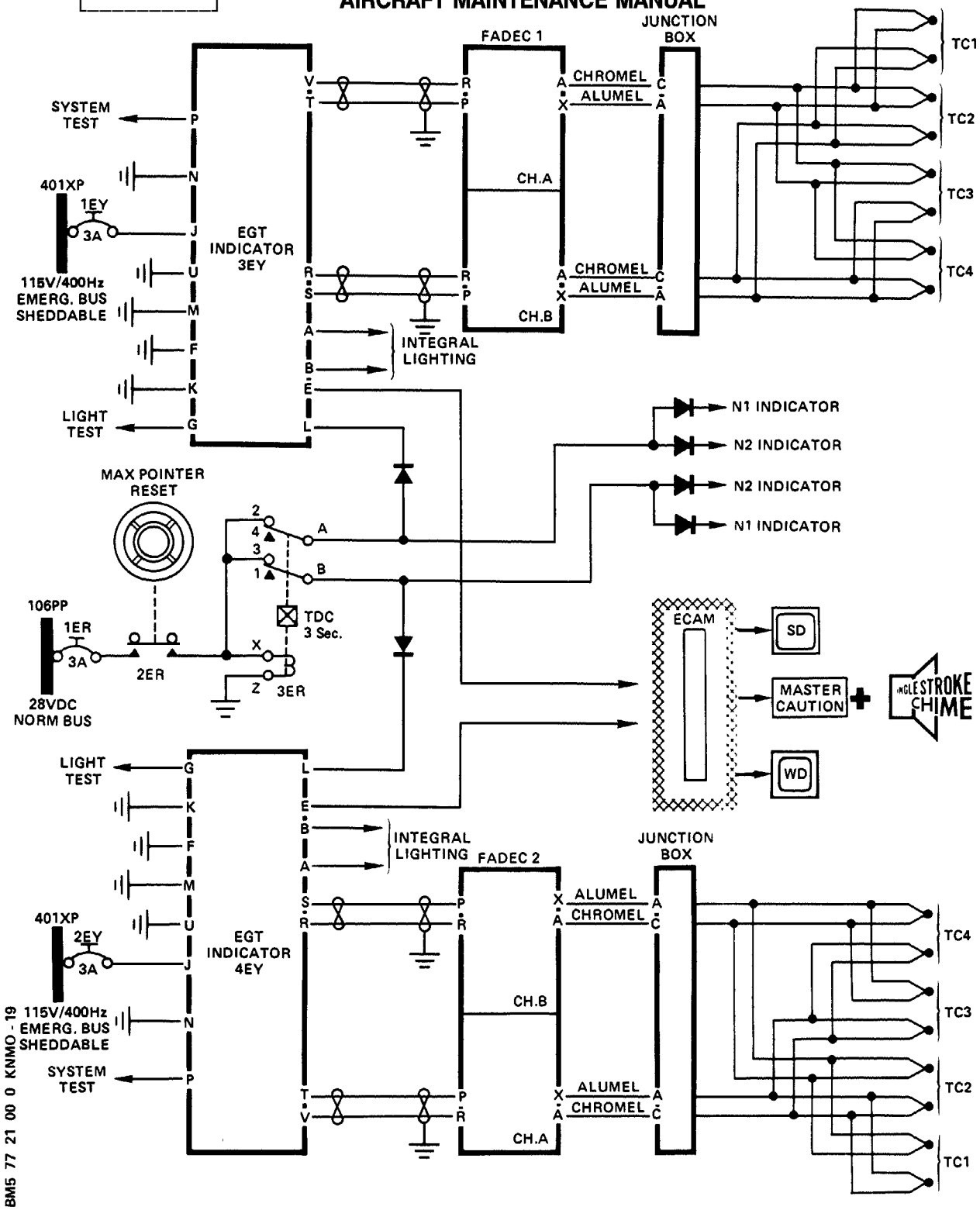
EGT Indicator
Figure 007



BM5 77 21 00 0 KKM0 02

R

EGT Indicator
Figure 008



EGT Indicator - Electrical Circuit
Figure 009

- the ENGINE system page appears on the right ECAM DU.

R When the BITE test is released, the indicator returns to normal operation and warnings disappear.

NOTE : The OVERTEMPERATURE pointer on the indicator will return to red line value (625°C) by pushing the MAX POINTER RESET pushbutton switch.

**ON A/C 101-104,

Post SB 72-2032 For A/C 101-104,

NOTE : The OVERTEMPERATURE pointer on the indicator will return to red line value (650°C) by pushing the MAX POINTER RESET pushbutton switch.

**ON A/C 101-200,

(2) In case of failure (loss of signal or wrong signal, internal failure of the indicator), only the center element of each digit will appear on the counter (----).
In case of power supply loss, the display of the counter will be black.

(3) On receipt of a ground signal from the light test pushbutton switch (0.5 s minimum duration) all digits become black for less than 1 second, then display 8 for less than 1 second. If the test signal is not there anymore the digits return to their pretest value. If the test signal is still activated, a second test sequence starts.

B. Indication System Test
(Ref. Fig. 009)
When the FADEC ground test is activated, the actual EGT indication is given by the indicator through the selection logic.
In order to test the redundancies of the indications a system test is available by selecting the FADEC "TEST".
When the FADEC TEST is selected with the test selector switch located on the maintenance test panel (120VU) the entire EGT indication system is tested. In this configuration in case of failure (loss of at least one input signal to the indicator : total loss of the signal, invalid signal) the center element of each digit will appear on the counter (----) and the pointer goes at the lower position. In absence of failure the indication is maintained. To identify this test, the indicator receives a discrete (28VDC) from the test selection logic.

5. Operational Usage

A. Starting and Inflight Relight
The EGT is a primary parameter to be monitored during a start.
As soon as fuel/air mixture is ignited, EGT raises rapidly and must be closely monitored to avoid exceeding the limit temperature of 520°C. In case of EGT exceeding 520°C during ground start attempt, the engine shall be immediately shut down and then motored with the starter to achieve an

acceptable EGT level (180°C or below).
A corrective action must be taken before any new start.

R **ON A/C 101-104,

R Post SB 72-2032 For A/C 101-104,

As soon as fuel/air mixture is ignited, EGT raises rapidly and must be closely monitored to avoid exceeding the limit temperature of 535°C. In case of EGT exceeding 535°C during ground start attempt, the engine shall be immediately shut down and then motored with the starter to achieve an acceptable EGT level (180°C or below).

**ON A/C 101-200,

A corrective action must be taken before any new start.

1. EGT Indication Calibration Test

A. General

The purpose of this test is to verify the EGT display integrity by feeding a signal to the input of the indicator and comparing the simulated value with that read on the indicator.

B. Equipment and Materials

ITEM	DESIGNATION
(1)	Access Platform
(2)	Circuit Breaker Safety Clips
(3)	ARINC Multiword Generator
Referenced Procedures	
- 24-41-00, P. Block 301	AC External Power Control
- 71-13-00, P. Block 301	Cowl Doors

C. Procedure

(1)Job set-up

(a)Open, safety and tag the circuit breakers and open left hand fan cowl door (Ref. 71-13-00, P. Block 301).

(b)Install access platform.

(c)Energize the aircraft electrical network (Ref. 24-41-00, P. Block 301). Make certain that electronic racks ventilation is correct.

(d)On the left forward junction box, disconnect FADEC channels "A" and "B" output plugs (D4999P and D4998P) (Ref. Fig. 501).

(2)Test

NOTE : A single channel ARINC multiword generator may be used, testing each channel with the other non-tested output plug connected.

(a)Install ARINC multiword generator on the plugs of the left forward junction box.

(b)Select channel "A" on the ARINC multiword generator.

(c)Adjust the ARINC multiword generator to drive label 345 from 0°C to 800°C.

(d)Check that indicator pointer and digital display indicate the same value as the ARINC multiword generator.

(e)Select channel "B" on the ARINC multiword generator.

(f)Adjust the ARINC multiword generator to drive the label 345 from 800°C to 0°C.

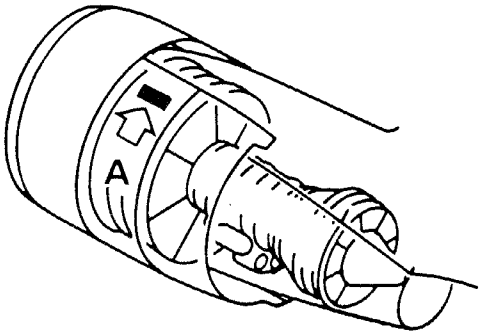
(g)Check that indicator pointer and digital display indicate the same value as the ARINC multiword generator.

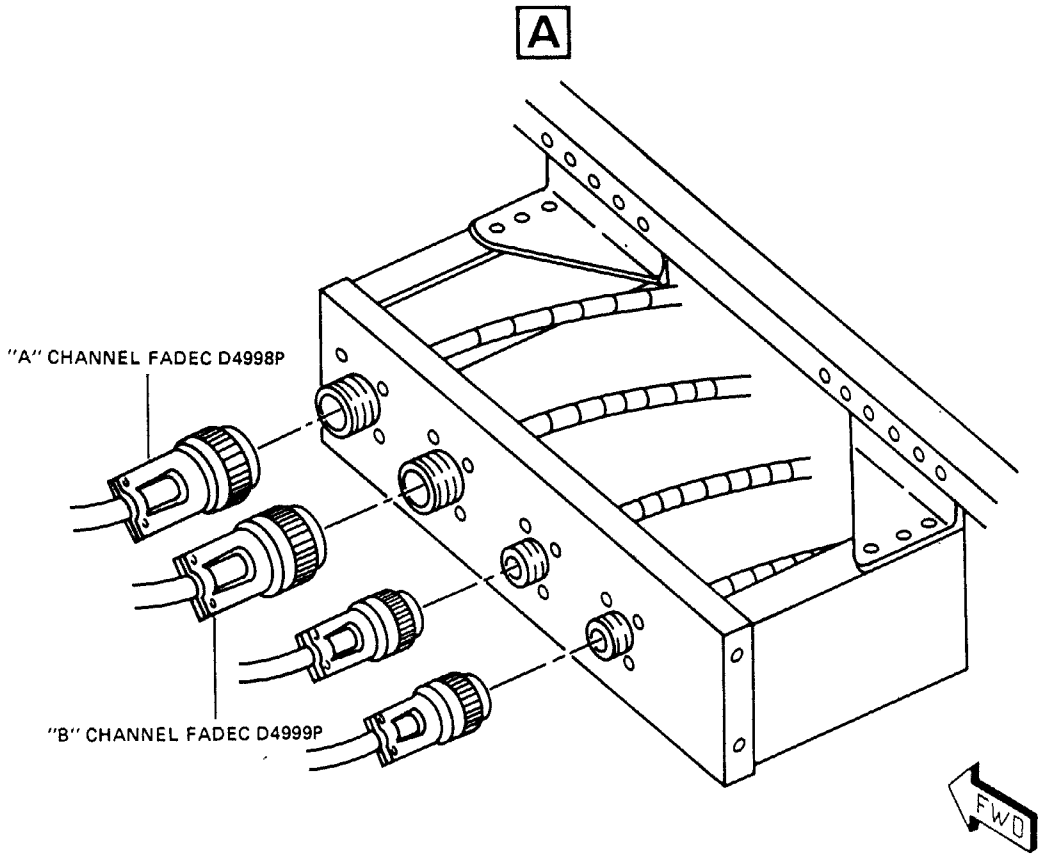
(3)Close-up

(a)Disconnect ARINC multiword generator.

(b)Connect the plugs of the FADEC channel "A" and channel "B". (Ref. Fig. 501)

(c)De-energize the aircraft electrical network (Ref. 24-41-00, P. Block 301).





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Left Forward Junction Box
Figure 501

(d)Remove access platform.
(e)Close left fan cowl door (Ref. 71-13-00, P. Block 301).
(f)Remove safety clips and tags and close circuit breakers.

EGT (TT4.95) THERMOCOUPLE CABLE - REMOVAL/INSTALLATION

1. General

A. Removal/Installation procedure is identical for left and right engines.

B. Access to the EGT thermocouple cable is through the thrust reverser doors (Ref. 71-13-00, P. Block 301).

2. Equipment and Materials

ITEM	DESIGNATION
A.	Access Platform
B.	Resistant Corrosion Steel Lockwire (MS9226-03) (Ref. 70-00-00)
C.	Circuit Breaker Safety Clips
D.	Torque Wrench
E. Material No.P03-001	Oils (Ref. 70-00-00)
Referenced Procedures	
- 71-00-00, P. Block 501	Power Plant - General
- 71-13-00, P. Block 301	Cowl Doors

3. Procedure

A. Job Set-Up
(1)Install access platform.
(2)Open, safety and tag the following circuit breakers :

PANEL	SERVICE	IDENT.	LOCATION
FOR ENGINE 1			
133VU	ENG1/SCU SUPPLY GND	35KS	333/T76
133VU	ENG1/SCU SUPPLY FLT	37KS	333/T75
FOR ENGINE 2			
133VU	ENG2/SCU SUPPLY GND	34KS	333/T85
133VU	ENG2/SCU SUPPLY FLT	36KS	333/T84

(3)Open fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

B. Removal
(1)Remove the EGT (TT4.95) thermocouple cable. For engines without the revised TT4.95 cable and PT4.95 sensing manifold for increased engine core clearance (pre SB PW4 ENG 72-134) (Ref. Fig. 401, 402).
(a)Right side
1 Remove the four nuts and lockwashers that attach the cable leads to the thermocouple terminal studs. Remove the cable leads from the studs. Install the lockwashers and nuts on the studs. Do this step at the two thermocouple locations. (Ref. Fig. 401) (Sheet 2/4)
2 Remove the lockwire and four screws that attach the cover and ground terminal to the junction box. Remove the cover. (Ref. Fig. 402)

3 Remove the two screws that attach the upper and lower clamp halves and the left and right thermocouple cables to the junction box. Remove the clamp halves.

4 Remove the nuts that attach the W6 cable leads and the right and left thermocouple cable leads to the junction box terminal studs. Remove the leads from the studs. Install the nuts on the studs.

5 Remove the four bolts that attach the inner front bracket and inner rear bracket to the outer support bracket at approximately the 7 o'clock position on the exhaust case. Remove the inner bracket from the engine. (Ref. Fig. 401) (Sheet 4/4)

6 Remove the four bolts securing the front and rear ends of the outer support bracket to the brackets on Flanges P and T. Remove the outer support bracket.

7 Remove the bolts and nuts that attach the cable clamps to the brackets on Flange T. Remove the cable from the engine.

(b)Left side

1 Remove the four nuts and lockwashers that attach the cable leads to the thermocouple terminal studs. Remove the cable leads from the studs. Install the lockwashers and nuts on the studs. Do this step at the two thermocouple locations. (Ref. Fig. 401) (Sheet 4/4)

2 Remove the lockwire and four screws that attach the cover and ground terminal to the junction box. Remove the cover. (Ref. Fig. 402)

3 Remove the two screws that attach the upper and lower clamp halves and the left and right thremocouple cable leads to the junction box. Remove the clamp halves.

4 Remove the nuts that attach the W6 cable leads and the right thermo-couple cable leads to the junction box terminal studs. Remove the leads from the studs. Install the nuts on the studs.

5 Remove the four bolts that attach the inner front bracket and inner rear bracket to the outer support bracket at apporximately the 7 o'clock position on the exhaust case. Remove the inner brackets from the engine. (Ref. Fig. 401) (Sheet 4/4)

6 Remove the four bolts securing the front and rear ends of the outer support bracket to the brackets on Flanges P and T. Remove the outer support bracket.

7 Remove the bolts and nuts that attach the cable clamps to all brackets and adjacent PT4.95 manifold clamps.

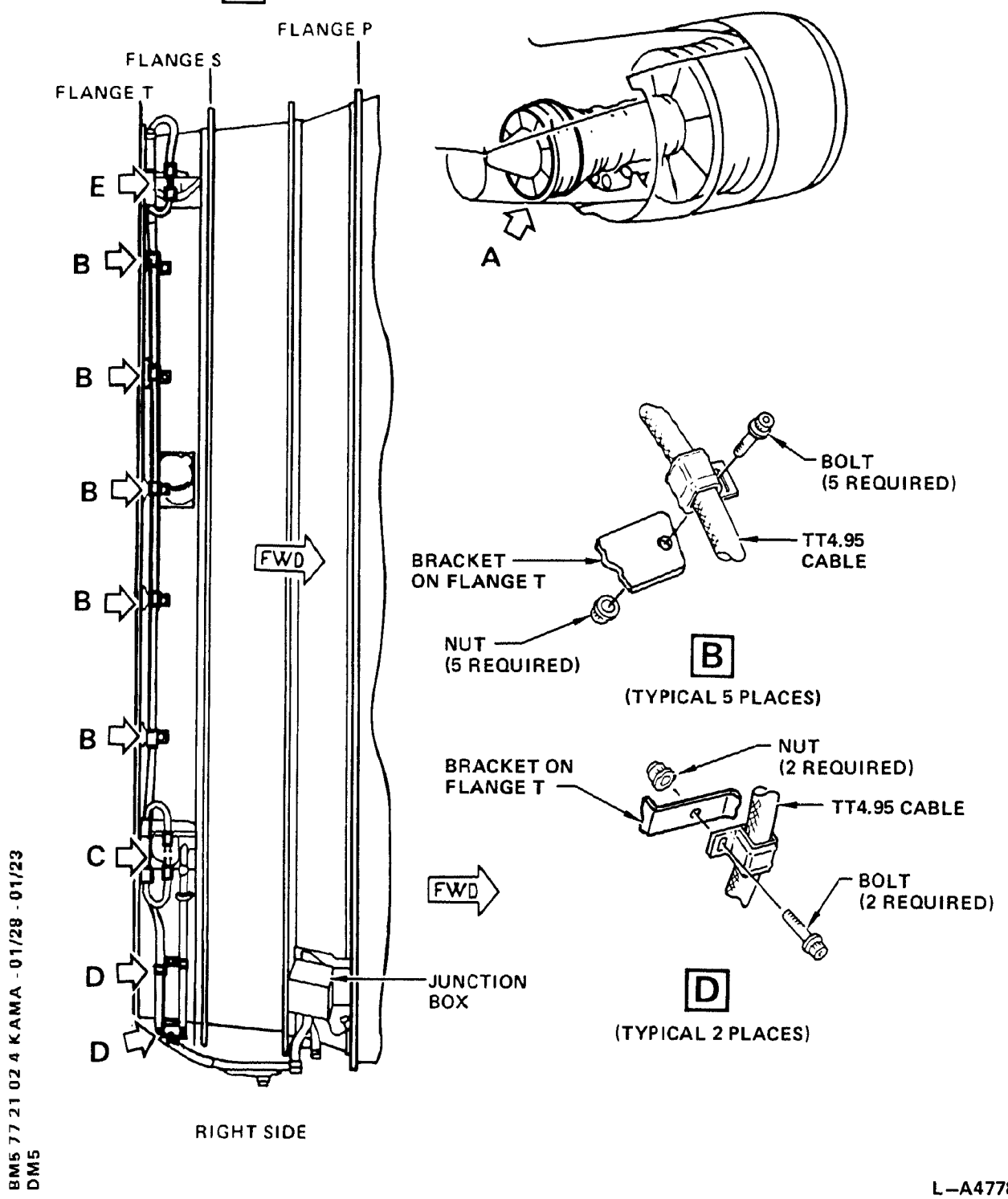
8 Remove the lockwire and bolt that attach the cable clamp and pressure probe to the exhaust case at the 10 o'clock position. (Ref. Fig. 401) (Sheet 4/4). Remove the cable from the engine.

NOTE : For more information on the maintenance of the thermocouple cable assembly, see EGT (TT4.95) thermocouple box and cable component maintenance manual, 77-21-04 (Harco Laboratories).

(2)Remove the EGT (TT4.95) thermocouple cable. For engines with the revised TT4.95 cable and PT4.95 sensing manifold for increased engine core clearance (post SB PW4 ENG 72-134) (Ref. Fig. 403, 404).

(a)Right side

1 Remove the four nuts and lockwashers that attach the cable leads to the thermocouple terminal studs. Remove the cable leads from the studs. Install the lockwashers and nuts on the studs. Do this step at the two thermocouple locations. (Ref. Fig. 403) (Sheet 2/5)



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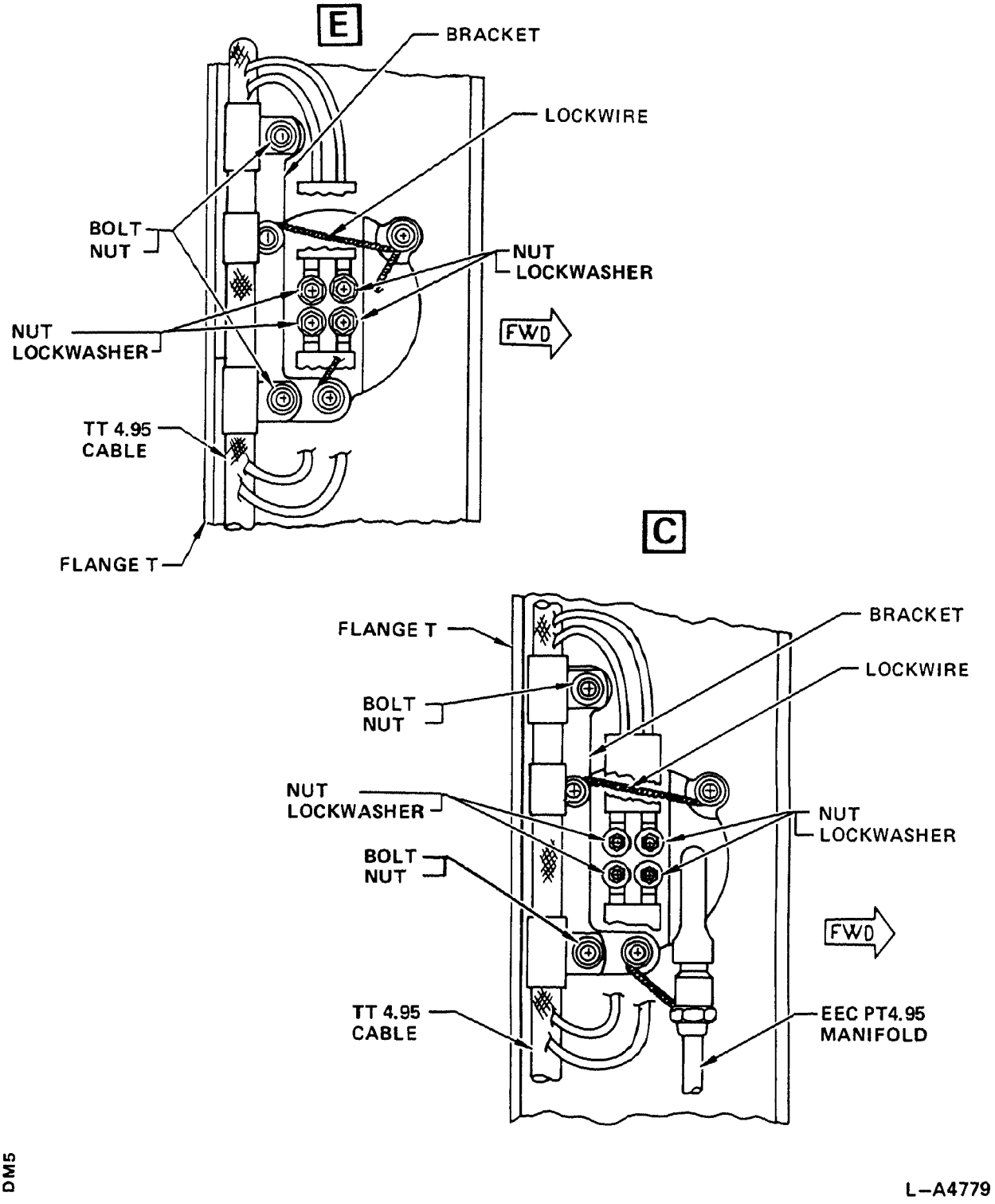
EGT (TT4.95) (Pre SB PW4 ENG 72-134)
Sheet 1
Figure 401



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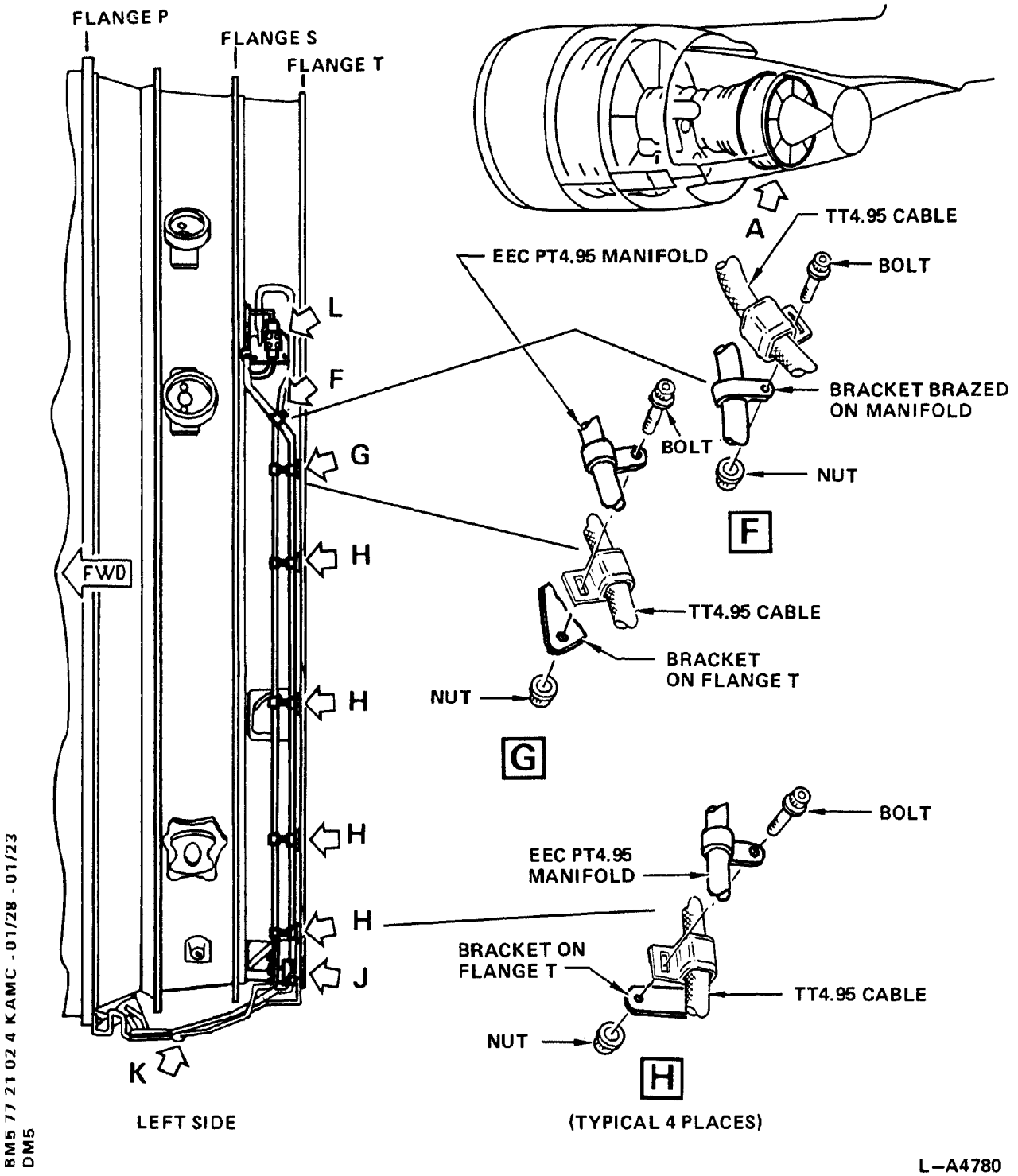
EGT (TT4.95) (Pre SB PW4 ENG 72-134)
Sheet 2
Figure 401



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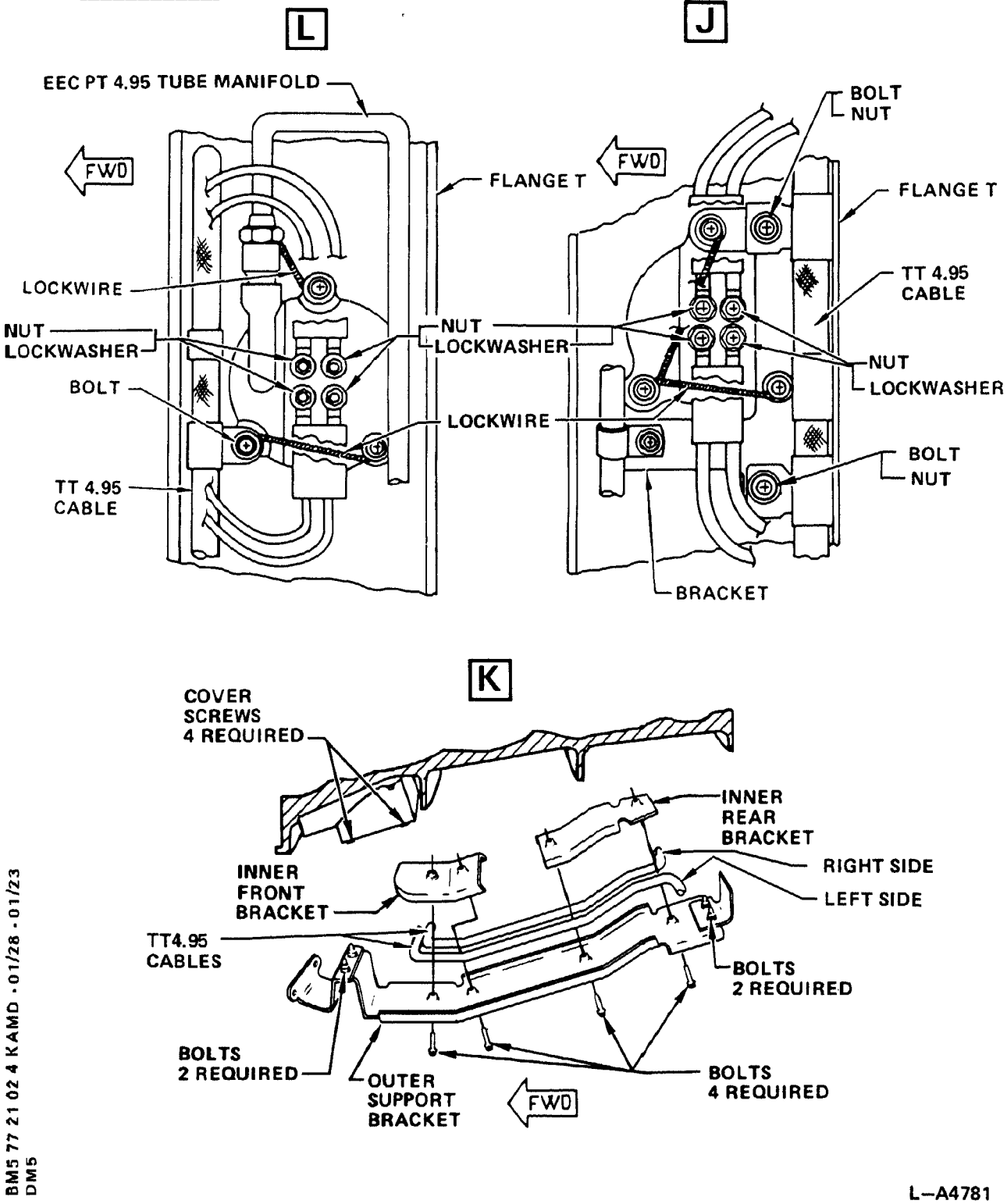
EGT (TT4.95) (Pre SB PW4 ENG 72-134)
Sheet 3
Figure 401



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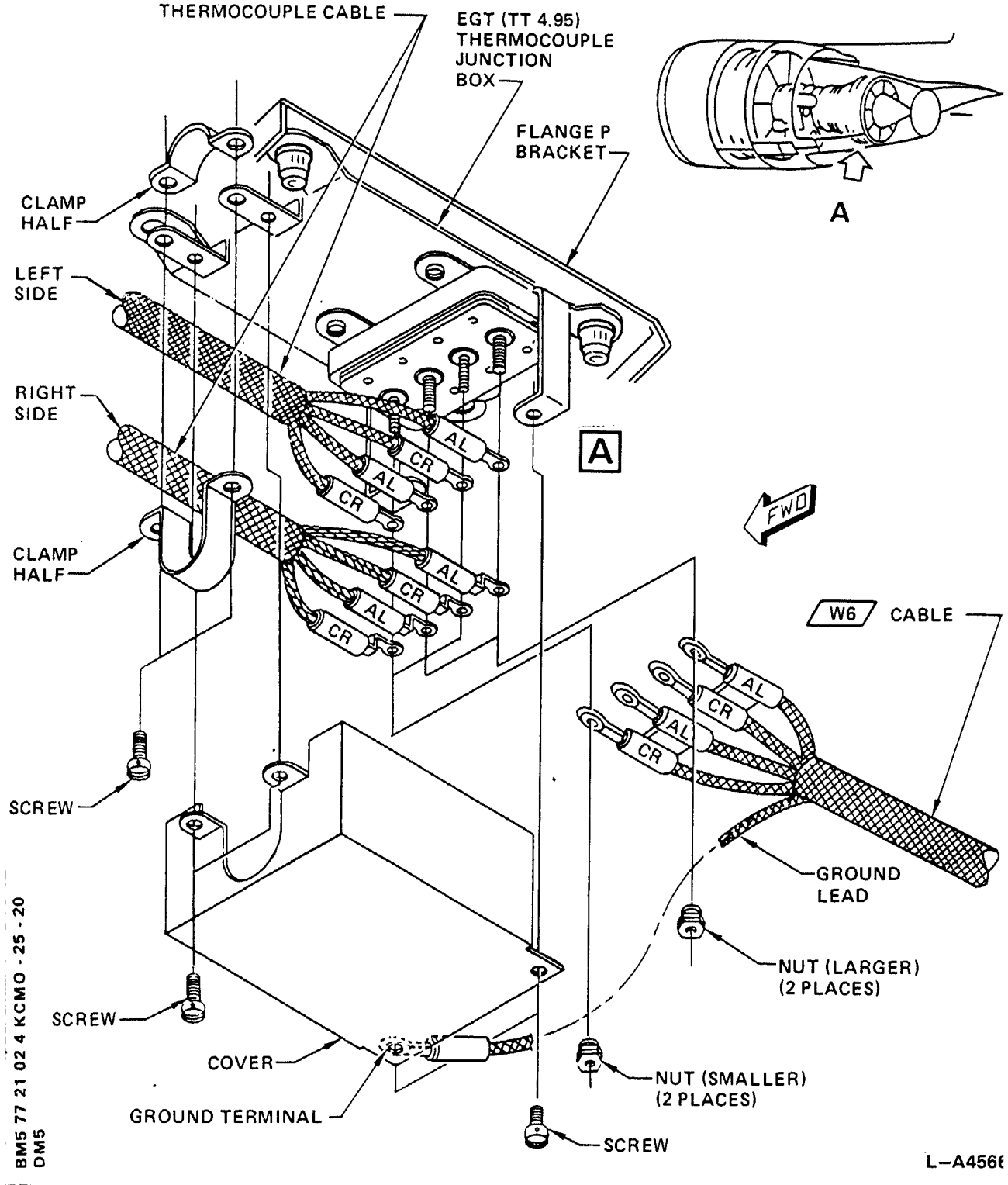
EGT (TT4.95) (Pre SB PW4 ENG 72-134)
Sheet 4
Figure 401



EGT (TT4.95) Thermocouple Cable Junction Box
Figure 402

2 Remove the nut, bolt and clamps that attach the bottom two leads to the EEC PT4.95 manifold at the 4:30 O'clock thermocouple. (Ref. Fig. 403) (Sheet 2/5) and the left and right thermocouple cables to the junction box. Remove the clamp halves.

3 Remove the lockwire and four screws that attach the cover and ground terminal to the junction box. Remove the cover. (Ref. Fig. 404)

4 Remove the two screws that attach the upper and lower clamp halves and the left and right thremocouple cables to the junction box. Remove the clamp halves.

5 Remove the nuts that attach the W6 cable leads and the right thermocouple cable leads to the junction box terminal studs. Remove the leads from the studs. Install the nuts on the studs.

6 Remove the bolts that attach the front positioning plate to the front support bracket. Remove the positioning plate. (Ref. Fig. 403) (Sheet 5/5)

7 Remove the bolts and nut that attach the positioning plate to the support bracket at approximately the 5 o'clock position. Remove the positioning plate. (Ref. Fig. 403) (Sheet 1/5)

8 Remove the bolts and nuts that attach the cable clamps to all the remaining brackets. Remove the cable from the engine.

(b)Left side

1 Remove the four nuts and lockwashers that attach the cable leads to the thermocouple terminal studs. Remove the cable leads from the studs. Install the lockwashers and nuts on the studs. Do this step at the two thermocouple locations. (Ref. Fig. 403) (Sheet 4/5)

2 Remove the nut, bolt and clamp that attach the top two leads to the bracket on the EEC PT4.95 tube at the 10 o'clock thermocouple (Ref. Fig. 403) (Sheet 4/5).

3 Remove the nut, bolt, spacer and clamp that attach the bottom two leads to the bracket at the 7 o'clock thermocouple (Ref. Fig. 403) (Sheet 4/5).

4 Remove the lockwire and four screws that attach the cover and ground terminal to the junction box. Remove the cover (Ref. Fig. 404).

5 Remove the two screws that attach the upper and lower clamp halves and the left and right thermocouple cables to the junction box. Remove the clamp halves.

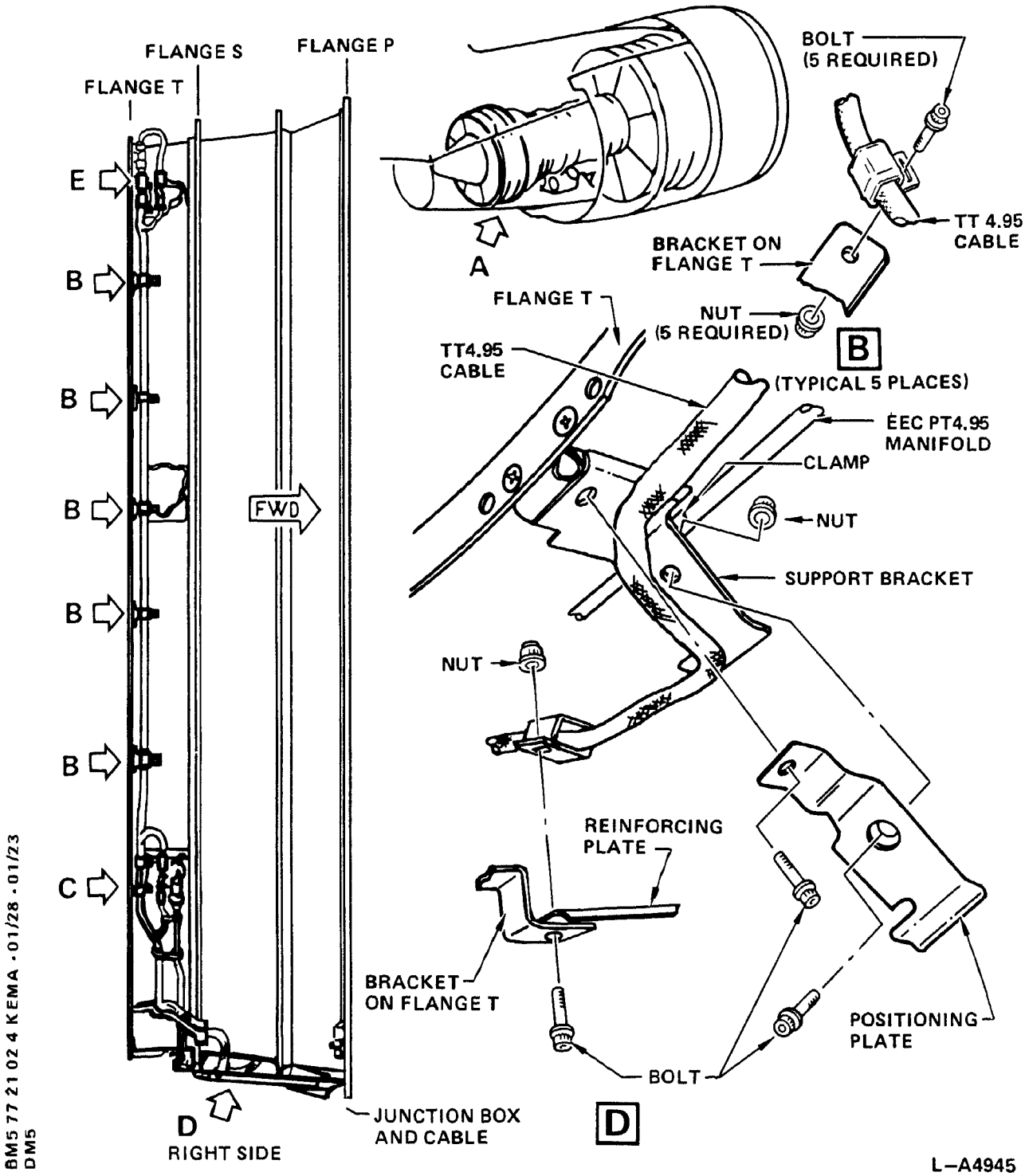
6 Remove the nuts that attach the W6 cable leads and the right and left thermocouple cable leads to the junction box terminal studs. Remove the leads from the studs. Install the nuts on the studs.

7 Remove the bolts that attach the front positioning plate to the front support bracket. Remove the positioning plate. (Ref. Fig. 403) (Sheet 5/5)

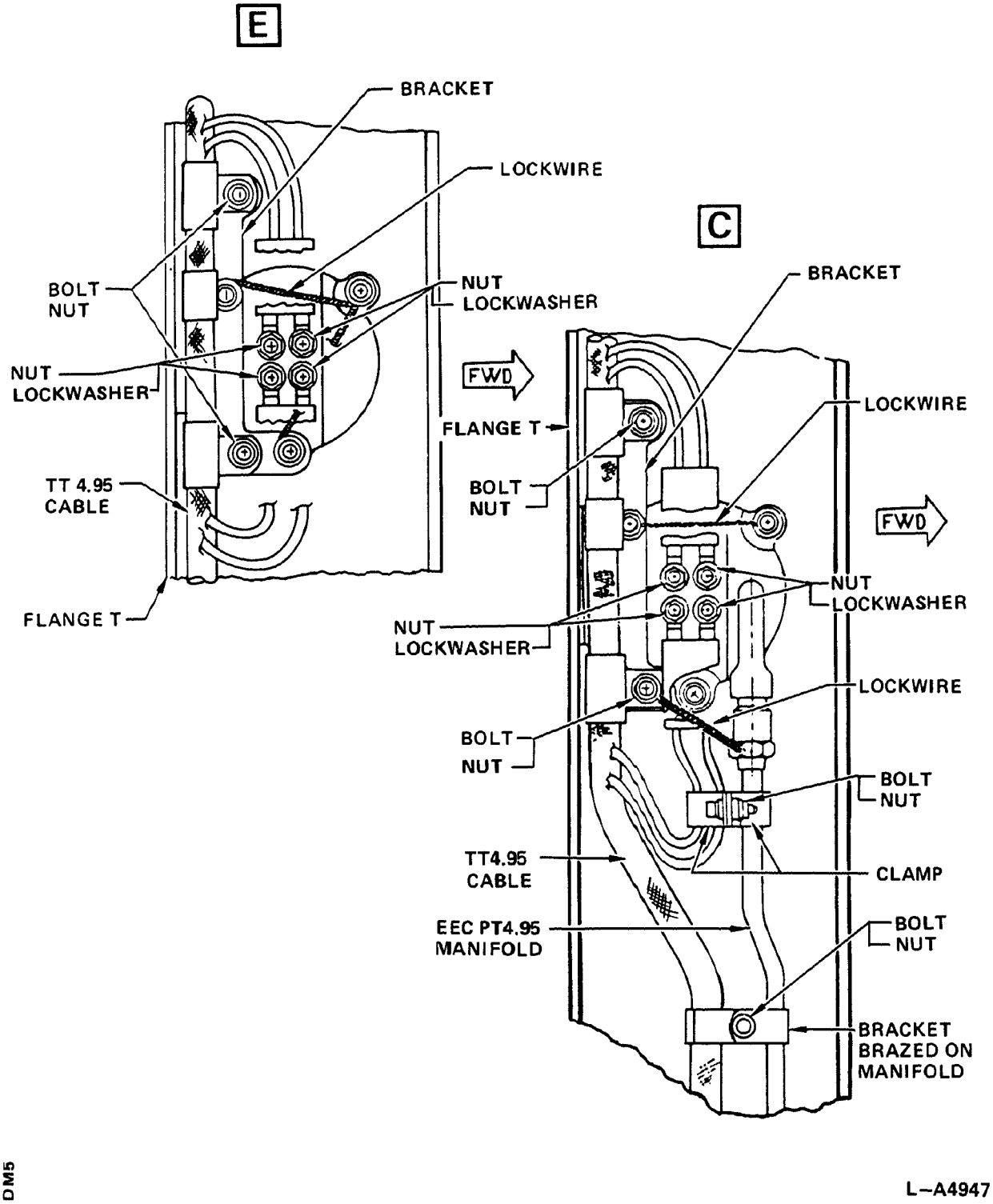
8 Remove the bolts that attach the rear positioning plate to the rear support bracket. Remove the positioning plate. (Ref. Fig. 403) (Sheet 5/5)

9 Remove the bolts and nuts that attach the cable clamps to all brackets and adjacent PT4.95 tube/manifold clamps.

10 Remove the lockwire and bolt that attach the cable clamp and pressure probe to the exhaust case at the 10 o'clock position (Ref. Fig. 403) (Sheet 4/5). Remove the cable from the engine.



EGT (TT4.95) Thermocouple Cable Assembly (Post SB PW4 ENG 72-134)
Sheet 1/5
Figure 403



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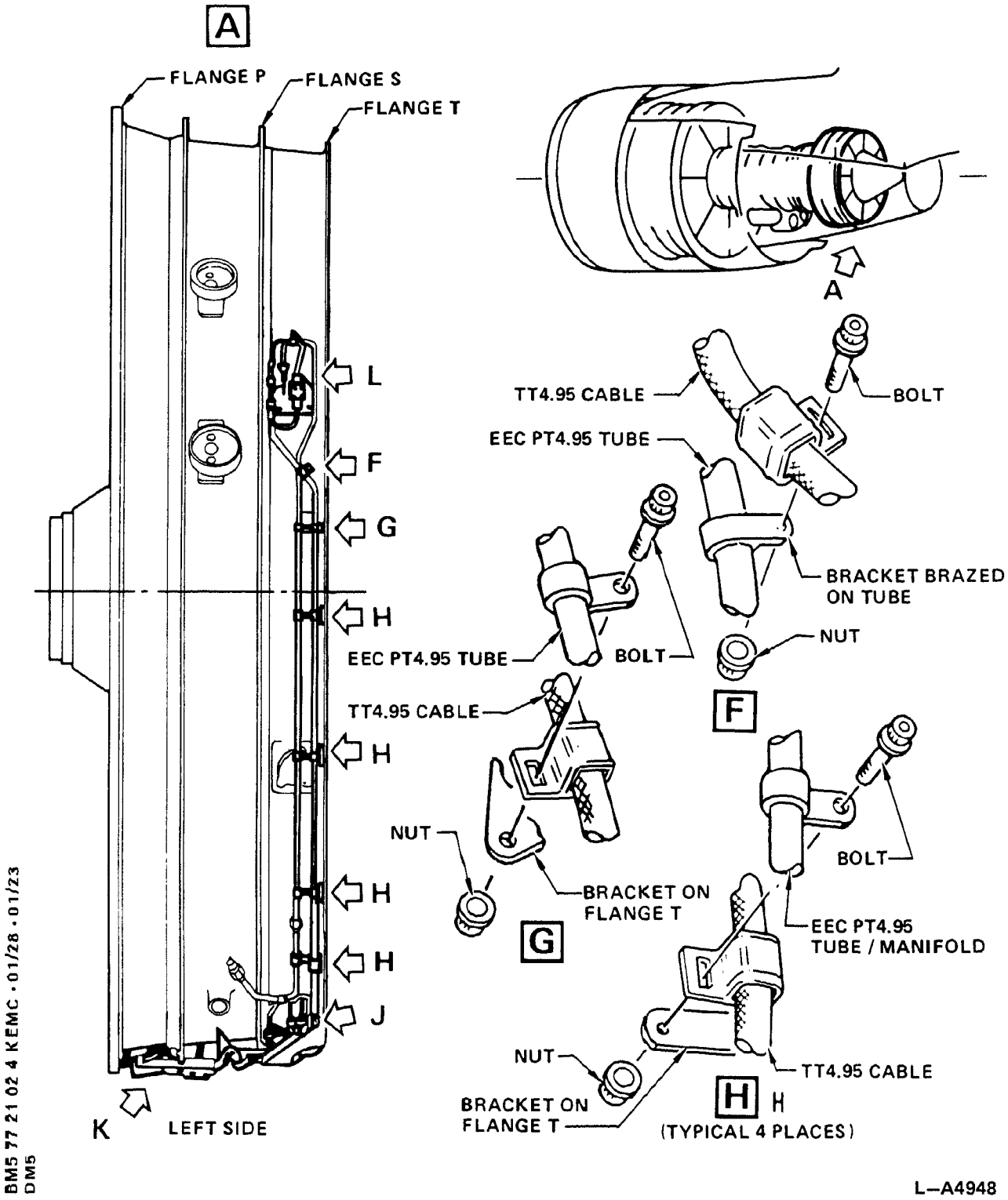
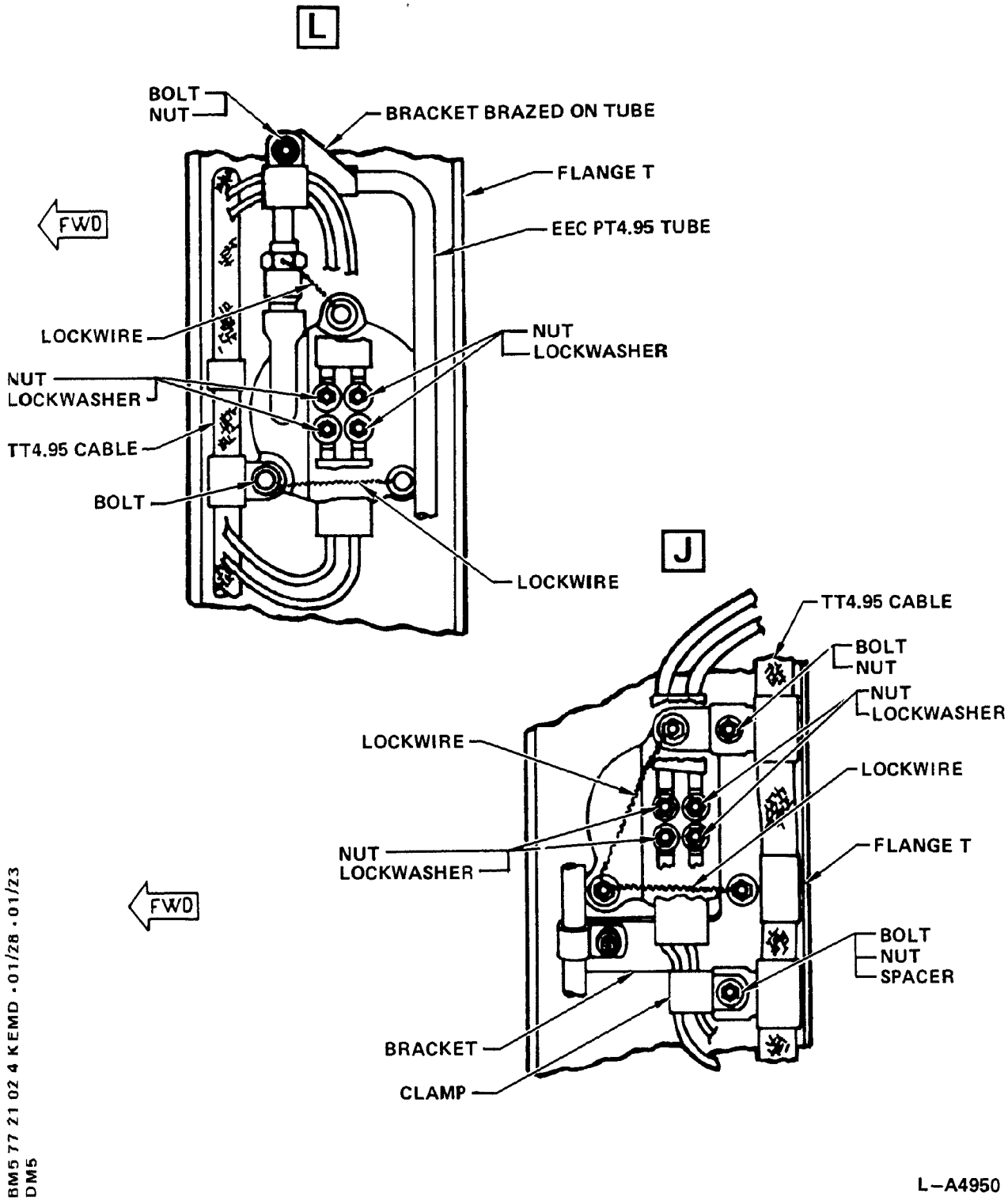
EGT (TT4.95) Thermocouple Cable Assembly (Post SB PW4 ENG 72-134)
Sheet 2/5
Figure 403



EGT (TT4.95) Thermocouple Cable Assembly (Post SB PW4 ENG 72-134)
Sheet 3/5
Figure 403



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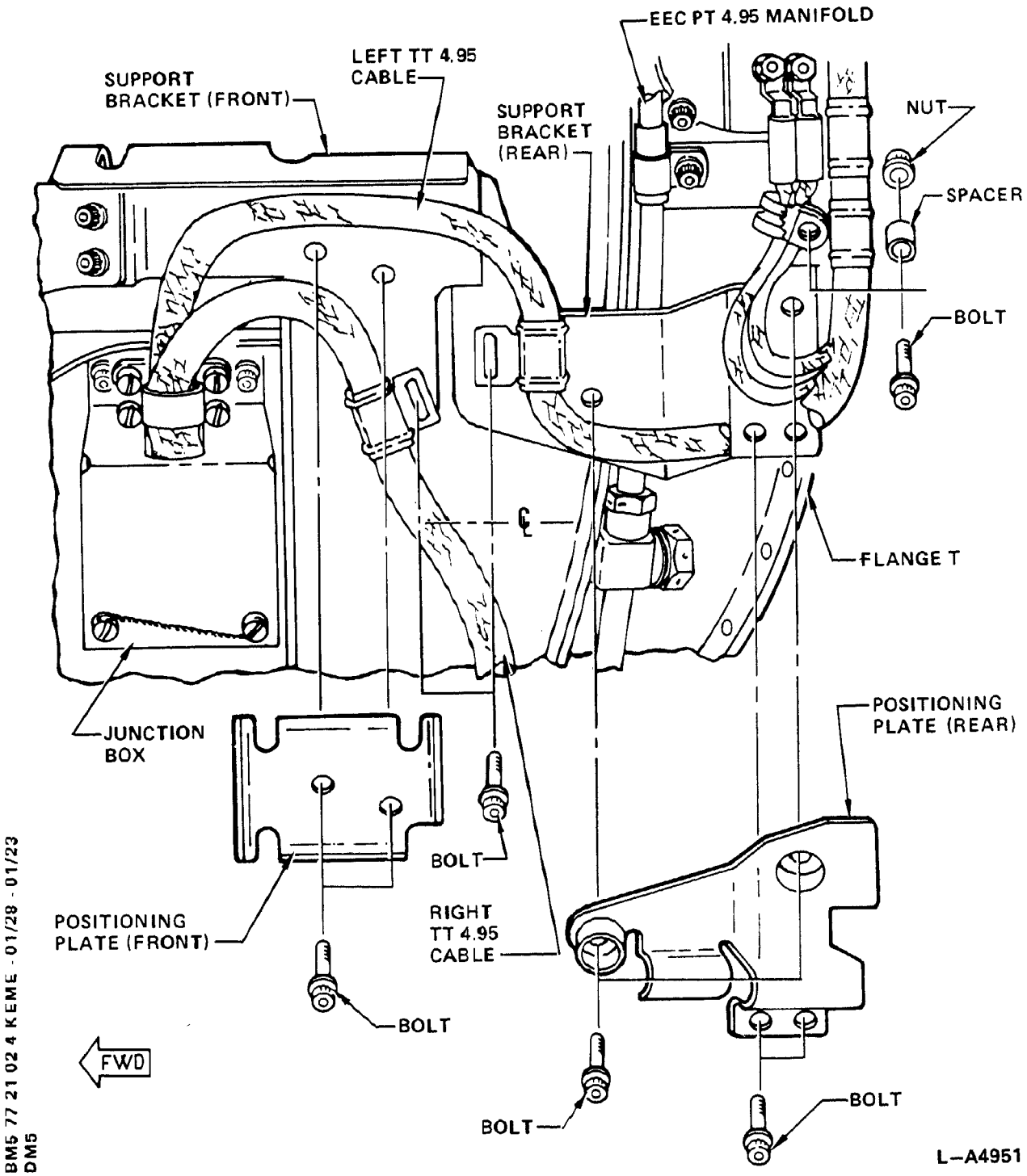
EGT (TT4.95) Thermocouple Cable Assembly (Post SB PW4 ENG 72-134)
Sheet 4/5
Figure 403



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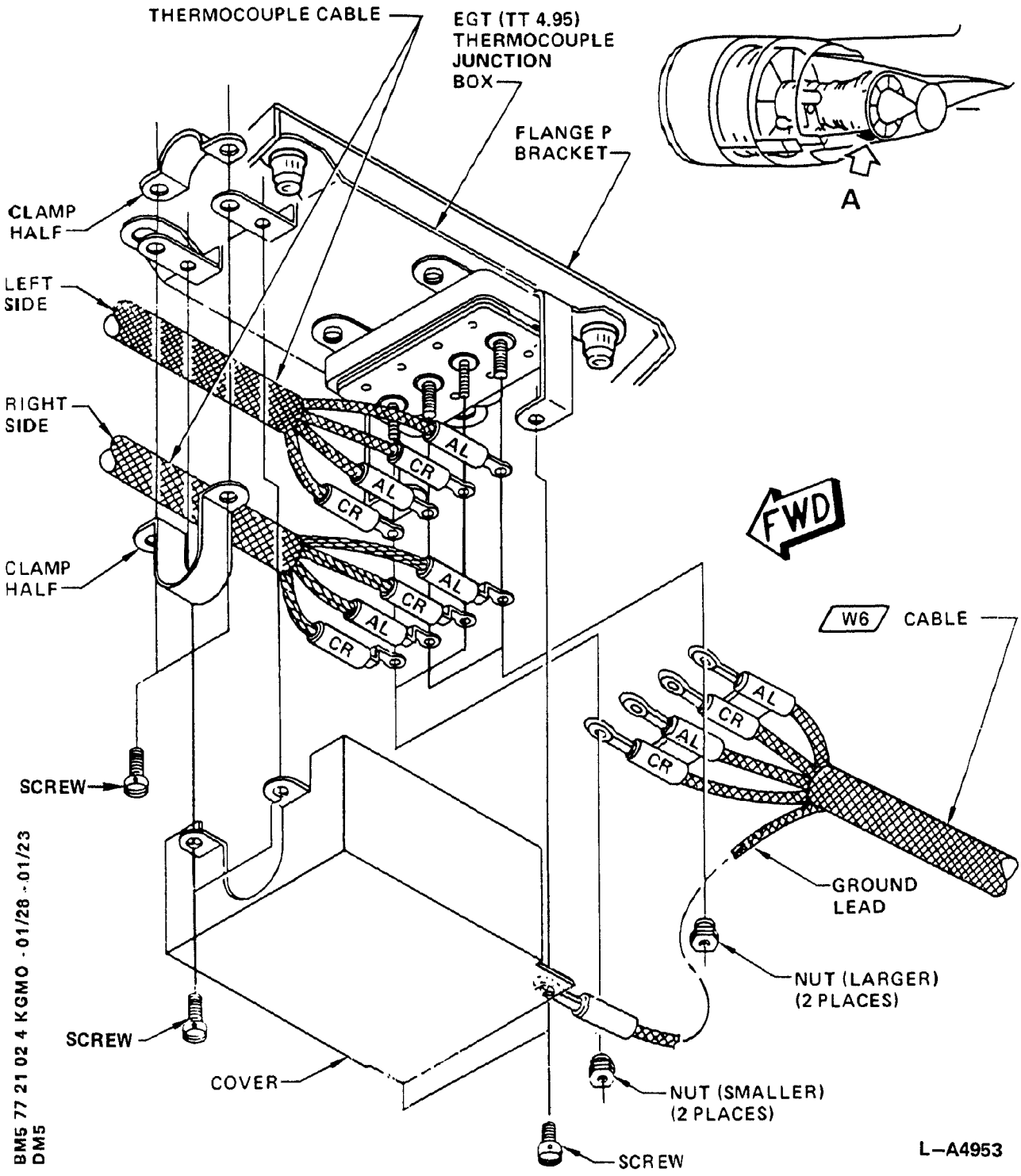
EGT (TT4.95) Thermocouple Cable Assembly (Post SB PW4 ENG 72-134)
Sheet 5/5
Figure 403



EGT (TT4.95) Thermocouple Cable Assembly (Post SB PW4 ENG 72-134)
Jonction Box
Figure 404

C. Installation

(1)Install the EGT (TT4.95) thermocouple cable. For engines without the revised TT4.95 cable and PT4.95 sensing manifold for increased engine core clearance (Pre SB PW4 ENG 72-134) (Ref. Fig. 401, 402).

(a)Right side

1 Remove the nuts and lockwashers from the thermocouple terminal studs at the 1:00 and 4:30 o'clock positions. Install the thermocouple cable leads to the thermocouple studs. Install the lockwashers and nuts (stepped washer face next to the lockwasher) handtight only.
CAUTION : TO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

2 Remove the nut from the junction box terminal studs. Connect the thermocouple cable leads and the W6 cable leads to the studs. Install the nuts. TORQUE the alumel (larger) nuts to between 18 and 22 lbf.in. (0.20 and 0.24 m.daN). TORQUE the chromel (smaller) nuts to between 15 and 18 lbf.in. (0.16 and 0.20 m.daN) (Ref. Fig. 402).

3 Install the clamp halves around the cables at the junction box. Attach the clamp halves to the ears on the junction box with screws, threads lubricated with Material No.P03-001. TORQUE the screws to between 16 and 22 lbf. in. (0.18 and 0.24 m.daN).

4 Install the cover on the junction box. Put the W6 cable ground lead terminal below the front corner of the cover. Attach the cover and ground terminal with four screws, threads lubricated with Material No.P03-001. TORQUE the screws to between 16 and 22 lbf.in. (0.18 and 0.24 m.daN) and wirelock.

5 Install the cable clamps to the brackets adjacent to the two thermocouples. Attach the clamps with bolts, threads lubricated with Material No.P03-001 and nuts. TORQUE the bolts to between 36 and 40 lbf.in. (0.40 and 0.45 m.daN) (Ref. Fig. 401) (Sheet 2/4).

6 Install the cable clamps to the brackets on Flange T at seven locations. Attach the clamps with bolts, threads lubricated with Material No.P03-001 and nuts. TORQUE the bolts to between 36 and 40 lbf.in. (0.40 and 0.45 m.daN) (Ref. Fig. 401) (Sheet 1/4).

7 Install the outer support bracket to the brackets on Flange P and T. Attach the bracket with bolts, threads lubricated with Material No.P03-001. TORQUE the bolts to between 36 and 40 lbf.in. (0.40 and 0.45 m.daN) (Ref. Fig. 401) (Sheet 4/4).

8 Install the front and rear inner brackets over the cables and to the outer support bracket. Attach the brackets with bolts, threads lubricated with Material No.P03-001. TORQUE the bolts to between 36 and 40 lbf. in. (0.40 and 0.45 m.daN).
CAUTION : TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

9 Align the thermocouple cable leads attached to the studs on the thermocouple so they are parallel to one another. Torque the nuts at each thermocouple as follows:
- TORQUE the alumel connections (larger studs) to between 10 and 15 lbf. in. (0.11 and 0.16 m.daN).
- TORQUE the chromel connections (smaller studs to between 8 and 12 lbf. in. (0.09 and 0.13 m.daN).

NOTE : After the nuts are torqued, make sure that the cable leads

DO NOT CONTACT the adjacent bolt heads or lockwire.

(b)Left side

1 Remove the nuts and lockwashers from the thermocouple terminal studs at the 10 and 7 o'clock positions. Install the thermocouple cable leads to the thermocouple studs. Install the lockwashers and nuts (stepped washer face next to the lockwasher) handtight only.
CAUTION : TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

2 Remove the nuts from the junction box terminal studs. Connect the thermocouple cable leads and the W6 cable leads to the studs. Install the nuts. TORQUE the alumel (larger) nuts to between 18 and 32 lbf.in. (0.20 and 0.36 m.daN). TORQUE the chromel (smaller) nuts to between 15 and 18 lbf. in. (0.16 and 0.20 m.daN) (Ref. Fig. 402).

3 Install the clamp halves around the cables at the junction box. Attach the clamp halves to the ears on the junction box with screws, threads lubricated with Material No.P03-001. TORQUE the screws to between 16 and 22 lbf.in. (0.18 and 0.24 m.daN).

4 Install the cover on the junction box. Put the W6 cable ground lead terminal below the front corner of the cover. Attach the cover and ground terminal with four screws, threads lubricated with Material No.P03-001. TORQUE the screws to between 16 and 22 lbf. in. (0.18 and 0.24 m.daN). Install lockwire.

5 Attach the cable clamp and pressure probe to the exhaust case at the 10 o'clock position with a bolt, threads lubricated with Material No.P03-001. TORQUE the bolt to between 75 and 85 lbf. in. (0.84 and 0.96 m.daN) and wirelock. (Ref. Fig. 401) (Sheet 4/4)

6 Install the cable clamps to the bracket adjacent the thermocouple at the 7 o'clock position. Attach the clamps with bolts, threads lubricated with Material No.P03-001 and nuts. TORQUE the bolts to between 36 and 40 lbf. in. (0.40 and 0.45 m.daN) (Ref. Fig. 401) (Sheet 4/4).

7 Install the cable clamps and the EEC PT4.95 manifold clamps to the brackets on Flange T. Attach the clamps with bolts, threads lubricated with Material No.P03-001 and nuts. TORQUE the bolts to between 36 and 40 lbf. in. (0.40 and 0.45 m.daN). (Ref. Fig. 401) (Sheet 3/4)

8 Install the cable clamp to the bracket brazed on the EEC PT4.95 manifold. Attach the clamp with bolt, threads lubricated with Material No.P03-001 and nut. TORQUE the bolt to between 36 and 40 lbf.in. (0.40 and 0.45 m.daN) (Ref. Fig. 401) (Sheet 3/4).

9 Install the outer support bracket to the brackets on Flange P and T. Attach the bracket with bolts, threads lubricated with Material No.P03-001. TORQUE the bolts to between 36 and 40 lbf. in. (0.40 and 0.45 m.daN). (Ref. Fig. 401) (Sheet 4/4)

10 Install the front and rear inner brackets over the cables and to the outer supportbracket. Attach the brackets, with bolts, threads lubricated with Material No.P03-001. TORQUE the bolts to between 36 and 40 lbf. in. (0.40 and 0.45 m.daN).
CAUTION : TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

11 Align the thermocouple cable leads attached to the studs on the thermocouple so they are parallel to one another. Torque the nuts at

each thermocouple as follows:
- TORQUE the alumel connections (larger studs) to between 10 and 15 lbf. in. (0.11 and 0.16 m.daN).
- TROQUE the chromel connections (smaller studs to between 8 and 12 lbf. in. (0.09 and 0.13 m.daN).

NOTE : After the nuts are torqued, make sure that the cable leads DO NOT CONTACT the adjacent bolt heads or lockwire.

(2)Install the EGT (TT4.95) thermocouple cable. For engines with the revised TT4.95 cable and PT4.95 sensing manifold for increased engine core clearance (Post SB PW4 ENG 72-134) (Ref. Fig. 403, 404).

(a)Right side

1 Remove the nuts and lockwashers from the thermocouple terminal studs at the 1:00 and 4:30 o'clock positions. Install the thermocouple cable leads to the thermocouple studs. Install the lockwashers and nuts (stepped washer face next to the lockwasher) handtight only.
CAUTION : TO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

2 Remove the nut from the junction box terminal studs. Connect the thermocouple cable leads and the W6 cable leads to the studs. Install the nuts. TORQUE the alumel (larger) nuts to between 18 and 22 lbf.in. (0.20 and 0.24 m.daN). TORQUE the chromel (smaller) nuts to between 15 and 18 lbf.in. (0.16 and 0.20 m.daN) (Ref. Fig. 404).

3 Install the clamp halves around the cables at the junction box. Attach the clamp halves to the ears on the junction box with screws, threads lubricated with Material No.P03-001. TORQUE the screws to between 16 and 22 lbf. in. (0.18 and 0.24 m.daN).

4 Install the cover on the junction box. Put the W6 cable ground lead terminal below the rear corner of the cover. Attach the cover and ground terminal with four screws, threads lubricated with Material No.P03-001. TORQUE the screws to between 16 and 22 lbf.in. (0.18 and 0.24 m.daN) and wirelock.

5 Install the cable clamps to the brackets adjacent to the two thermocouples. Attach the clamps with bolts, threads lubricated with Material No.P03-001 and nuts. TORQUE the bolts to between 36 and 40 lbf. in. (0.40 and 0.45 m.daN) (Ref. Fig. 403) (Sheet 2/5).

6 Install the cable clamps to the brackets on Flange T at five locations. Attach the clamps with bolts, threads lubricated with Material No.P03-001 and nuts. TORQUE the bolts to between 36 and 40 lbf.in. (0.40 and 0.45 m.daN) (Ref. Fig. 403) (Sheet 1/5).

7 Install the cable clamp to the bracket brazed on the EEC PT4.95 manifold at the 4:30 o'clock position. Attach the clamp with bolt, threads lubricated with Material No.P03-001 and nuts. TORQUE the bolt to between 36 and 40 lbf. in. (0.40 and 0.45 m.daN). (Ref. Fig. 403) (Sheet 2/5).

8 Make a loop in the thermocouple cable adjacent to the junction box. Attach the cable clamp, nearest to the loop, to the front support bracket with a bolt threads lubricated with Material No.P03-001. TORQUE the bolt to between 36 and 40 lbf. in. (0.40 and 0.45 m.daN) (Ref. Fig. 403) (Sheet 5/5).

9 Install the front positioning plate on the two cables with the spacers inboard, between the cables. Attach the plate to the front

support bracket with two bolts, threads lubricated with Material No.P03-001. TORQUE the bolts to between 36 and 40 lbf. in. (0.40 and 0.45 m.daN) (Ref. Fig. 403) (Sheet 5/5).

NOTE : The cables installed below the positioning plate will be compressed by the plate when torquing the bolts.

10 Install the positioning plate on the thermocouple cable at approximately the 5 o'clock position. Install the cable to the left of the inner spacer and to the right of the outer spacer on the plate. Attach the positioning plate and the clamp on the EEC PT4.95 manifold to the support bracket with two bolts, threads lubricated with Material No.P03-001 and a nut. TORQUE the bolts to between 36 and 40 lbf. in. (0.40 and 0.45 m.daN). (Ref. Fig. 403) (Sheet 1/5)

NOTE : The cable installed below the positioning plate will be compressed by the plate when torquing the bolts.

11 Install the cable clamp to the inboard side of the reinforcing plate at the 5:30 o'clock positions. Attach the clamp to the plate with a bolt, threads lubricated with Material No.P03-001 and a nut. TORQUE the bolt to between 36 and 40 lbf. in. (0.40 and 0.45 m.daN). (Ref. Fig. 403) (Sheet 1/5)

CAUTION : TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

12 Align the thermocouple cable leads attached to the studs on the thermocouples so they are parallel to one another. Torque the nuts at each thermocouple as follows :

- TORQUE the alumel connections (larger studs) to between 10 and 15 lbf. in. (0.11 and 0.16 m.daN).
- TORQUE the chromel connections (smaller studs) to between 8 and 12 lbf. in. (0.09 and 0.13 m.daN).

NOTE : After the nuts are torqued, make sure that the cable leads DO NOT CONTACT the adjacent bolt heads or lockwire.

13 Clamp the bottom two thermocouple leads at the 4:30 o'clock thermocouple to the EEC PT4.95 manifold 1/2 in. (12.700 mm) from the manifold nut. Attach the leads with two clamps, bolt, threads lubricated with Material No.P03.001) and a nut. TORQUE the nut to between 36 and 40 lbf. in. (0.40 and 0.45 m.daN). (Ref. Fig. 403) (Sheet 2/5)

(b)Left side

1 Remove the nuts and lockwashers from the thermocouple terminal studs at the 10 and 7 o'clock positions. Install the thermocouple cable leads to the thermocouple studs. Install the lockwashers and nuts (stepped washer face next to the lockwasher) handtight only.

CAUTION : TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

2 Remove the nuts from the junction box terminal studs. Connect the thermocouple cable leads and the W6 cable leads to the studs. Install the nuts. TORQUE the alumel (larger) nuts to between 18 and 22 lbf.in. (0.20 and 0.24 m.daN). TORQUE the chromel (smaller) nuts to between 15 and 18 lbf. in. (0.16 and 0.20 m.daN) (Ref. Fig. 404).

3 Install the clamp halves around the cables at the junction box. Attach the clamp halves to the ears on the junction box with screws, threads lubricated with Material No.P03-001. TORQUE the screws to between 16 and 22 lbf. in. (0.18 and 0.24 m.daN).

4 Install the cover on the junction box. Put the W6 cable ground lead terminal below the rear corner of the cover. Attach the cover and ground terminal with four screws, threads lubricated with Material No.P03-001. TORQUE the screws to between 16 and 22 lbf. in. (0.18 and 0.24 m.daN) and wirelock.

5 Attach the cable clamp and pressure probe to the exhaust case at the 10 o'clock position with a bolt, threads lubricated with Material No.P03-001. TORQUE the bolt to between 75 and 85 lbf. in. (0.84 and 0.96 m.daN) and wirelock. (Ref. Fig. 403) (Sheet 4/5)

6 Clamp the top two thermocouple leads at the 10 o'clock thermocouple to the bracket brazed on the EEC PT4.95 tube. Attach the clamp with bolt, threads lubricated with Material No.P03-001 and a nut. TORQUE the bolt to between 36 and 40 lbf. in. (0.40 and 0.45 m.daN) (Ref. Fig. 403) (Sheet 4/5).

7 Install the cable clamps and a clamp on the bottom two leads, to the bottom two leads, to the bracket adjacent to the thermocouple at the 7 o'clock position. Attach the clamps with bolts, threads lubricated with Material No.P03-001, nuts and spacer. Install the spacer between the lead clamp and the cable clamp. TORQUE the bolts to between 36 and 40 lbf. in. (0.40 and 0.45 m.daN). (Ref. Fig. 403) (Sheet 4/5)

8 Install the cable clamps and the EEC PT4.95 tube/manifold clamps to the brackets on Flange T. Attach the clamps with bolts, threads lubricated with Material No.P03-001 and nuts. TORQUE the bolts to between 36 and 40 lbf. in. (0.40 and 0.45 m.daN). (Ref. Fig. 403) (Sheet 3/5)

9 Install the cable to the bracket brazed on the EEC PT4.95 tube. Attach the clamp with bolts, threads lubricated with Material No.P03-001. TORQUE the bolts to between 36 and 40 lbf. in. (0.40 and 0.45 m.daN). (Ref. Fig. 403) (Sheet 3/5)

10 Make a loop in the thermocouple cable adjacent to the 7 o'clock thermocouple. Attach the cable clamp, nearest to the loop, to the rear support bracket with a bolt, threads lubricated with Material No.P03-001. TORQUE the bolt to between 36 and 40 lbf. in. (0.40 and 0.45 m.daN) (Ref. Fig. 403) (Sheet 5/5)

11 Install the rear positioning plate with the rear spacer inside the cable/thermocouple lead loop and the front spacer inside the cable adjacent to the cable clamp. Attach the positioning plate to the rear support bracket with four bolts, threads lubricated with Material No.P03-001. TORQUE the bolts to between 36 and 40 lbf. in. (0.40 and 0.45 m.daN). (Ref. Fig. 403) (Sheet 5/5)

12 Install the front positioning plate on the two cables with the spacers, inboard, between the cables. Attach the plate to the front support bracket with two bolts, threads lubricated with Material No. P03-001. TORQUE the bolts to between 36 and 40 lbf. in. (0.40 and 0.45 m.daN). (Ref. Fig. 403) (Sheet 5/5)

NOTE : The cables installed below the positioning plate will be compressed by the plate when torquing the bolts.

CAUTION : TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

13 Align the thermocouple cable leads attached to the studs on the thermocouples so they are parallel to one another. Torque the nuts at each thermocouple as follows:

- TORQUE the alumel connections (larger studs) to between 10 and 15 lbf. in. (0.11 and 0.16 m.daN).
- TORQUE the chromel connections (smaller studs) to between 8 and 12 lbf. in. (0.09 and 0.13 m.daN).

NOTE : After the nuts are torqued, make sure that the cable leads DO NOT CONTACT the adjacent bolt heads or lockwire.

D. Close-Up and Test

(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(2)Remove access platform.
(3)Close thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301).
(4)Remove safety clips and tags and close circuit breakers : 35KS, 37KS, 34KS, 36KS.
(5)Test engine per Test Reference Table (Ref. 71-00-00, P. Block 501).

EGT THERMOCOUPLE BOX AND CABLE (Tt4.95) - REMOVAL/INSTALLATION

1. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Access Platform
C.	Torque Wrench
D.	Resistant Corrosion Steel Lockwire (MS9226-03) (Ref. 70-00-00)
E. Material No.P03-001	Oils (Ref. 70-00-00)
Referenced Procedures	
- 71-00-00, P. Block 501	Power Plant-General
- 71-13-00, P. Block 301	Cowl Doors

2. Procedure

A. Job Set-Up

(1)Install access platform.

(2)Open, safety and tag the following circuit breakers :

PANEL	SERVICE	IDENT.	LOCATION
FOR ENGINE 1			
133VU	ENG1/SCU SUPPLY GND	35KS	333/T76
133VU	ENG1/SCU SUPPLY FLT	37KS	333/T75
FOR ENGINE 2			
133VU	ENG2/SCU SUPPLY GND	34KS	333/T85
133VU	ENG2/SCU SUPPLY FLT	36KS	333/T84

(3)Open fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

B. Removal

(1)Remove the EGT (TT4.95) box and cable assembly. For engines without the revised TT4.95 cable and PT4.95 sensing manifold for increased engine core clearance (Pre SB PW4 ENG 72-134) (Ref. Fig. 401, 402).

(a)Remove the four nuts and lockwashers that attach the cable leads to the thermocouple terminal studs. Remove the cable leads from the studs. Install the lockwashers and nuts on the studs. Do this step at the four thermocouple locations. (Ref. Fig. 401) (Sheets 2/4 and 4/4).

(b)Remove the lockwire and four screws that attach the cover and ground terminal to the junction box. Remove the cover (Ref. Fig. 402).

(c)Remove the nuts that attach the W6 cable leads to the junction box terminal studs. Remove the W6 cable leads from the studs. Install the nuts, cover, and screws handtight only.

(d)Remove the four bolts that attach the inner front bracket and inner rear bracket to the outer support bracket at approximately the 7 o'clock position on the exhaust case. Remove the inner brackets from the engine (Ref. Fig. 401) (Sheet 4/4).

(e)Remove the four bolts securing the front and rear ends of the outer support bracket to the bracket on Flange P and T. Remove the outer support bracket.

(f)Remove the lockwire and bolt that attach the cable clamp and pressure probe to the exhaust case at the 10 o'clock position. (Ref. Fig. 401) (Sheet 4/4)

(g)Remove the bolts and nuts that attach the cable clamps to all brackets and to adjacent PT4.95 manifold clamps.

(h)Remove the nuts that attach the box and cable assembly to the bracket on the Flange P. Remove the box and cable assembly from the engine.

R NOTE : If terminal stud replacement is necessary, see paragraphs D and
R E. For more information on the maintenance of the box and cable
R assembly, see EGT (TT4.95) Thermocouple Box and Cable Component
R Maintenance Manual, 77-21-04 (Harco Laboratories).

(2)Remove the EGT (TT4.95) box and cable assembly. For engine with the revised TT4.95 cable and PT4.95 sensing manifold for increased engine core clearance (Post SB PW4ENG 72-134) (Ref. Fig. 403, 404)

(a)Remove the four nuts and lockwashers that attach the cable leads to the thermocouple terminal studs. Remove the cable leads from the studs. Install the lockwashers and nuts on the studs. Do this step at the four thermocouple locations (Ref. Fig. 403) (Sheets 2/5 and 4/5).

(b)Remove the nut, bolt, and clamps that attach the bottom two leads to the EEC PT4.95 manifold at the 4:30 o'clock thermocouple. (Ref. Fig. 403) (Sheet 2/5).

(c)Remove the nut, bolt, and clamp that attach the top two leads to the bracket on the EEC PT4.95 tube at the 10 o'clock thermocouple. (Ref. Fig. 403) (Sheet 4/5).

(d)Remove the nut, bolt, spacer, and clamp that attach the bottom two leads to the bracket at the 7 o'clock thermocouple. (Ref. Fig. 403) (Sheet 4/5).

(e)Remove the lockwire and four screws that attach the cover to the junction box. Remove the cover (Ref. Fig. 404).

(f)Remove the nuts that attach the W6 cable leads to the junction box terminal studs. Remove the W6 cable leads from the studs. Install the nuts, cover, and screws handtight only.

(g)Remove the bolts and nut that attach the positioning plate to the support bracket of approximately the 5 o'clock position. Remove the positioning plate. (Ref. Fig. 403) (Sheet 1/5).

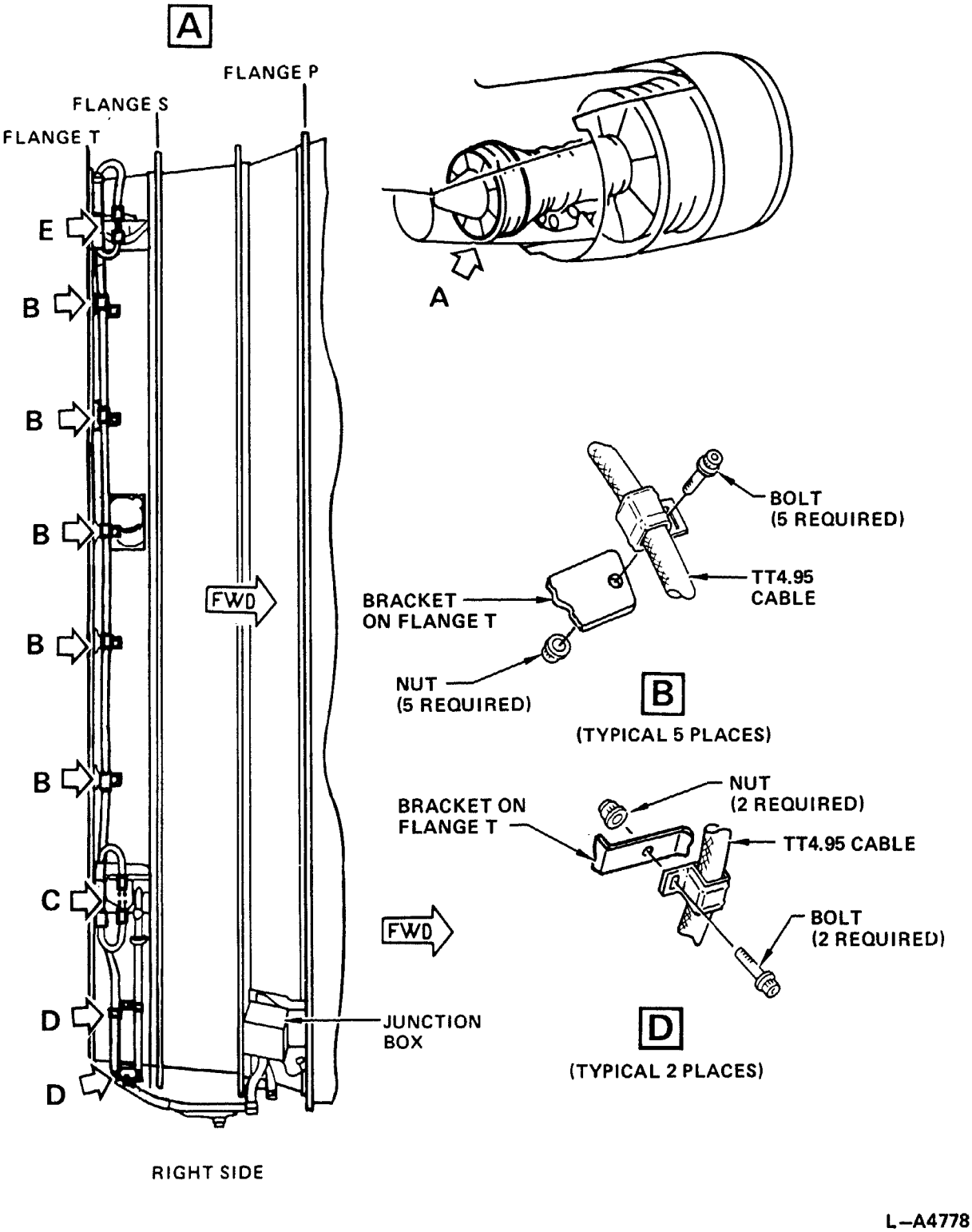
(h)Remove the bolts that attach the front positioning plate to the front support bracket. Remove the positioning plate. (Ref. Fig. 403) (Sheet 5/5).

(i)Remove the bolts that attach the rear positioning plate to the rear support bracket. Remove the positioning plate. (Ref. Fig. 403) (Sheet 5/5).

(j)Remove the lockwire and bolt that attach the cable clamp and pressure probe to the exhaust case at the 10 o'clock position. (Ref. Fig. 403) (Sheet 4/5).

(k)Remove the bolts and nuts that attach the cable clamps to all brackets and adjacent PT4.95 tube/manifold clamps.

(l)Remove the nuts that attach the box and cable assembly to the bracket on Flange P. Remove the box and cable assembly from the



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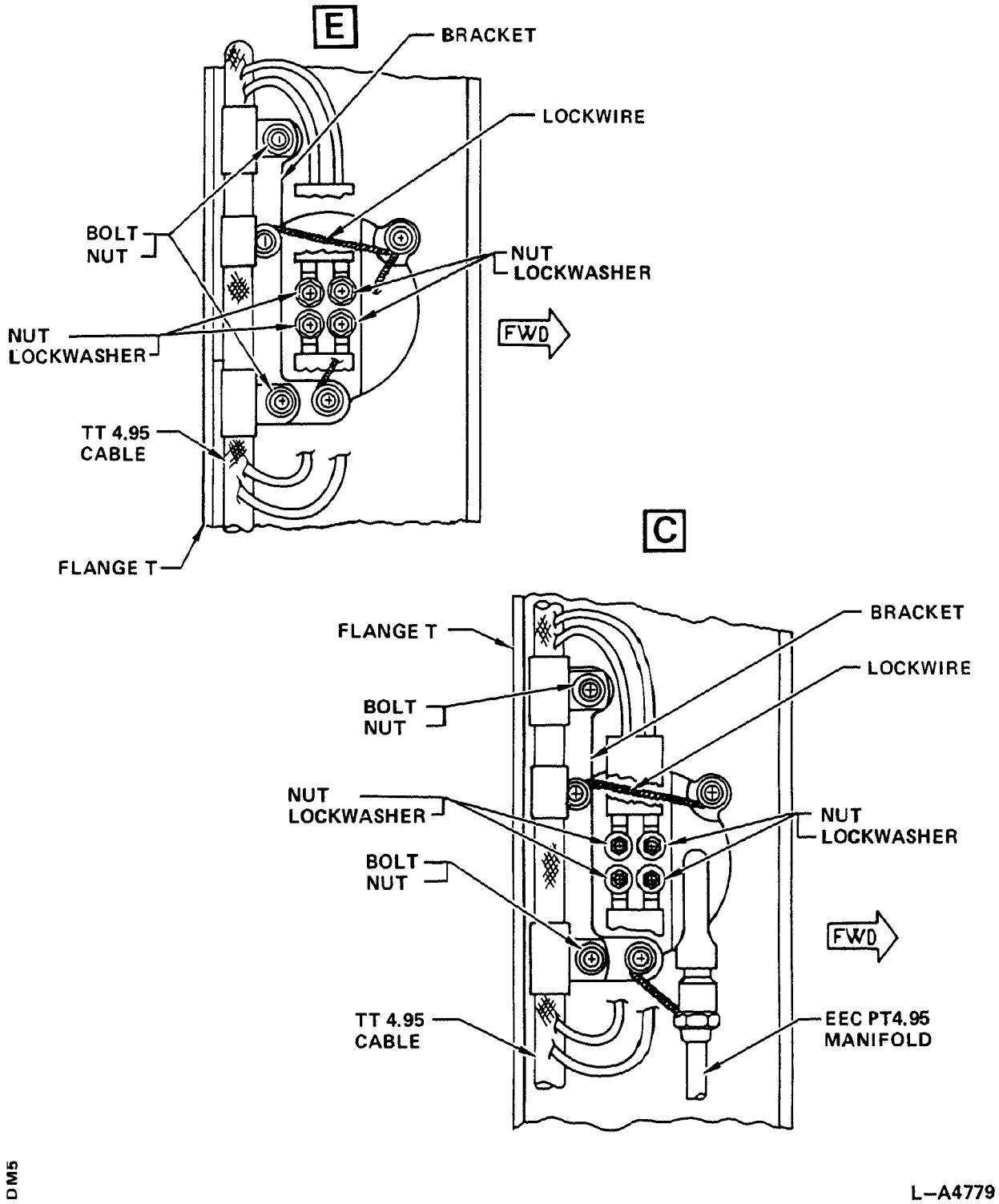
EGT (TT4.95) Box and Cable Assembly (Pre SB PW4ENG 72-134)
Sheet 1/4
Figure 401



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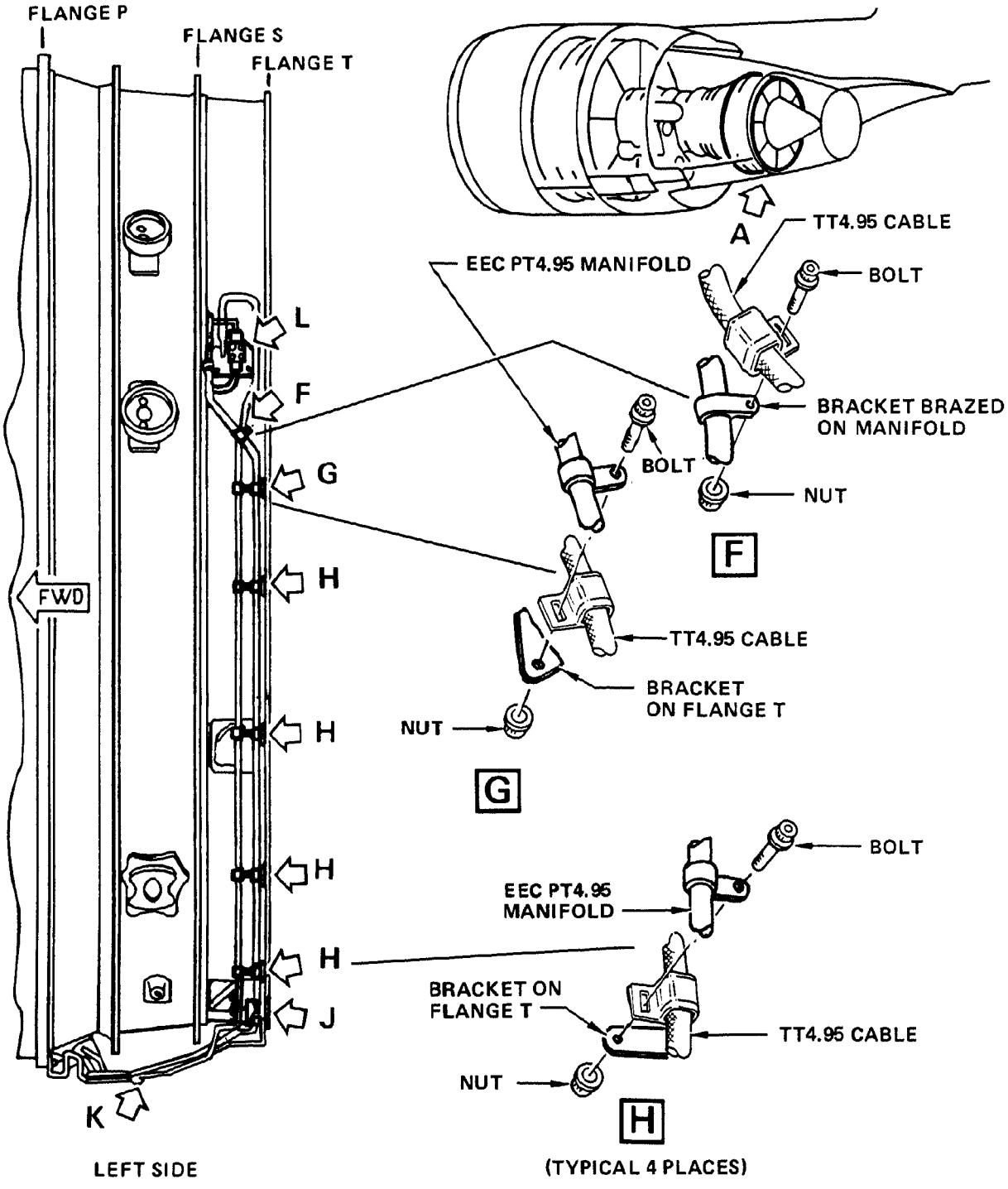
EGT (TT4.95) Box and Cable Assembly (Pre SB PW4ENG 72-134)
Sheet 2/4
Figure 401



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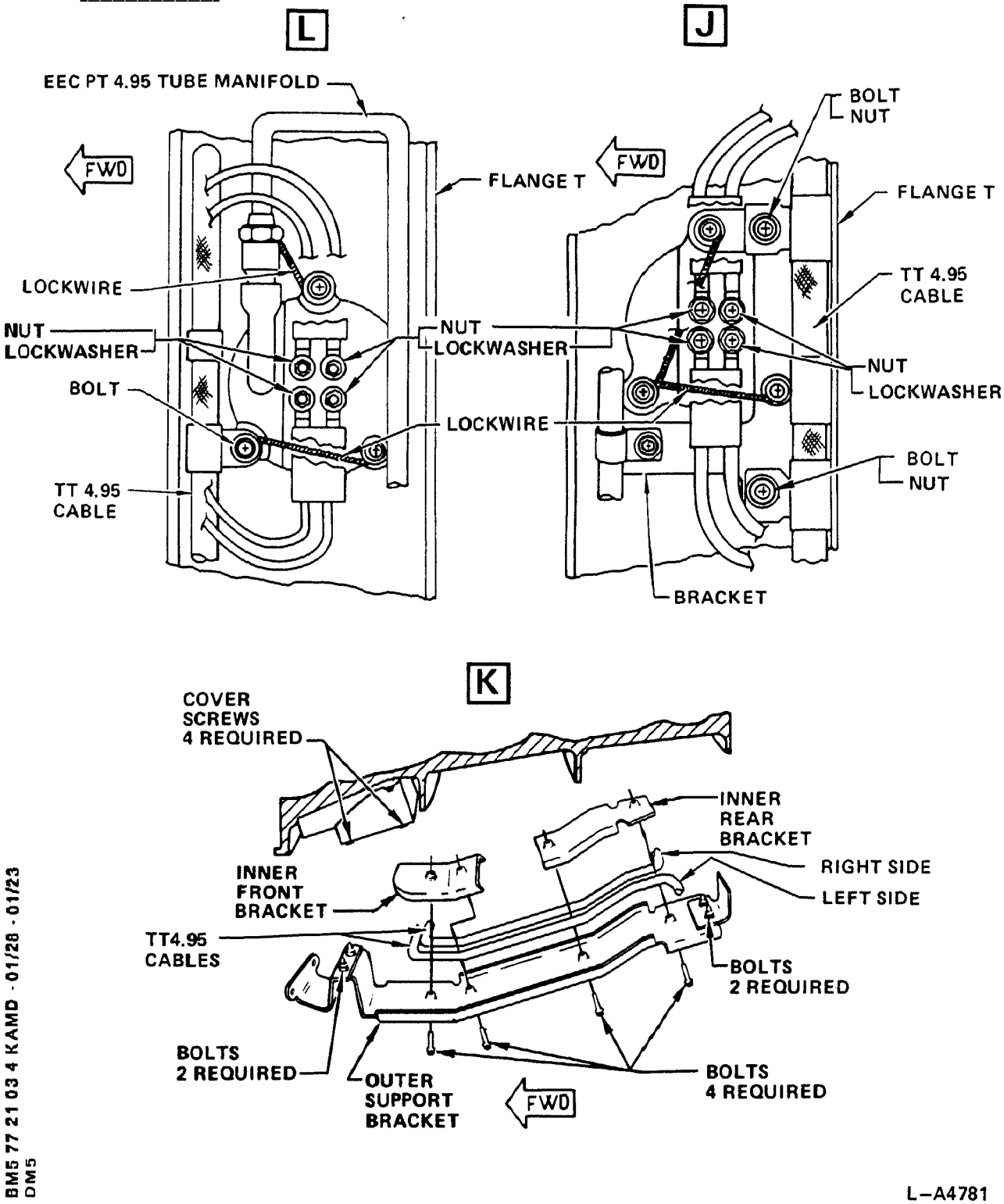
EGT (TT4.95) Box and Cable Assembly (Pre SB PW4ENG 72-134)
Sheet 3/4
Figure 401



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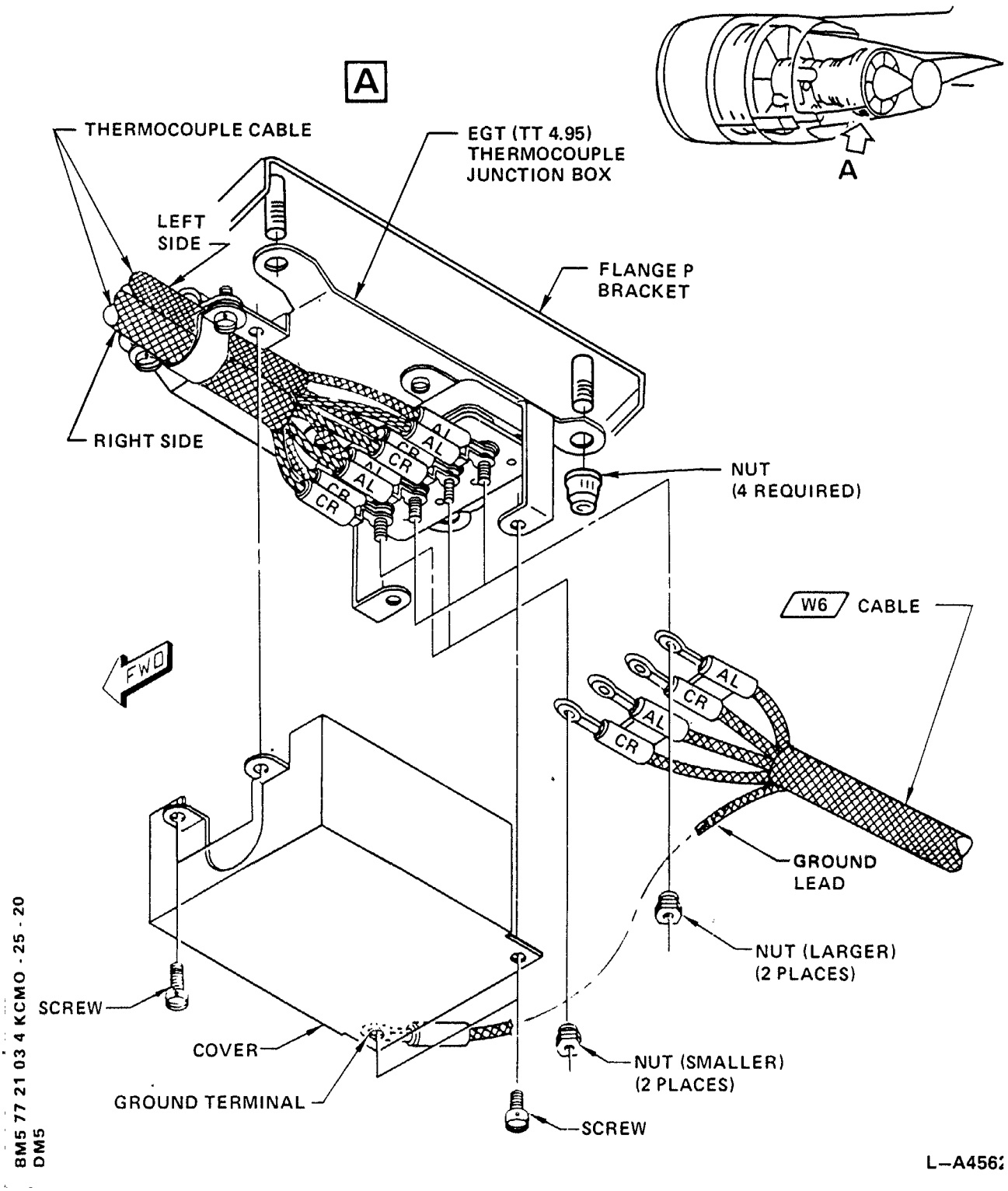
EGT (TT4.95) Box and Cable Assembly (Pre SB PW4ENG 72-134)
Sheet 4/4
Figure 401



EGT (TT4.95) Thermocouple Cable Junction Box
Figure 402

engine.

C. Installation

(1)Install the EGT (TT4.95) box and cable assembly. For engine without the revised TT4.95 cable and PT4.95 sensing manifold for increased engine core clearance (Pre SB PW4 ENG 72-134) (Ref. Fig. 401, 402).

(a)Install the box and cable assembly to the bracket on Flange P. Lubricate the threads on the bracket studs with Material No P03-001, and attach the junction box to the bracket with nuts. TORQUE the nuts to between 32 and 36 lbf. (0.36 and 0.46 m.daN).

(b)Remove the nuts and lockwashers from the thermocouple terminal studs at the four thermocouple locations. Install the thermocouple cable leads to the thermocouple studs. Install the lockwashers and nuts (stepped washer face next to the lockwasher) handtight only. (Ref. Fig. 403) (Sheets 2/4 and 4/4).

(c)Remove the lockwire and four screws that attach the cover to the junction box. Remove the cover (Ref. Fig. 402).

CAUTION : TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

CAUTION : USE OF LUBRICATION IS NOT PERMITTED ON EITHER THE STUDS OR NUTS.

(d)(Pre SB PW4ENG 77-20) Remove the nuts from the junction box terminal studs. Connect the W6 cable leads to the studs. Install the nuts. TORQUE the alumel (larger) nuts to between 18 and 22 lbf.in. (0.20 and 0.24 m.daN). TORQUE the chromel (smaller) nuts to between 15 and 18 lbf.in. (0.16 and 0.20 m.daN).

CAUTION : TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

CAUTION : USE OF LUBRICATION IS NOT PERMITTED ON EITHER THE STUDS OR LOCK NUTS.

CAUTION : ONCE A POST SB PW4ENG 77-20 NUT IS INSTALLED ONTO THE MATING STUD, YOU MUST NOT INSTALL A PRE SB PW4ENG 77-20 NUT ONTO THE STUD.

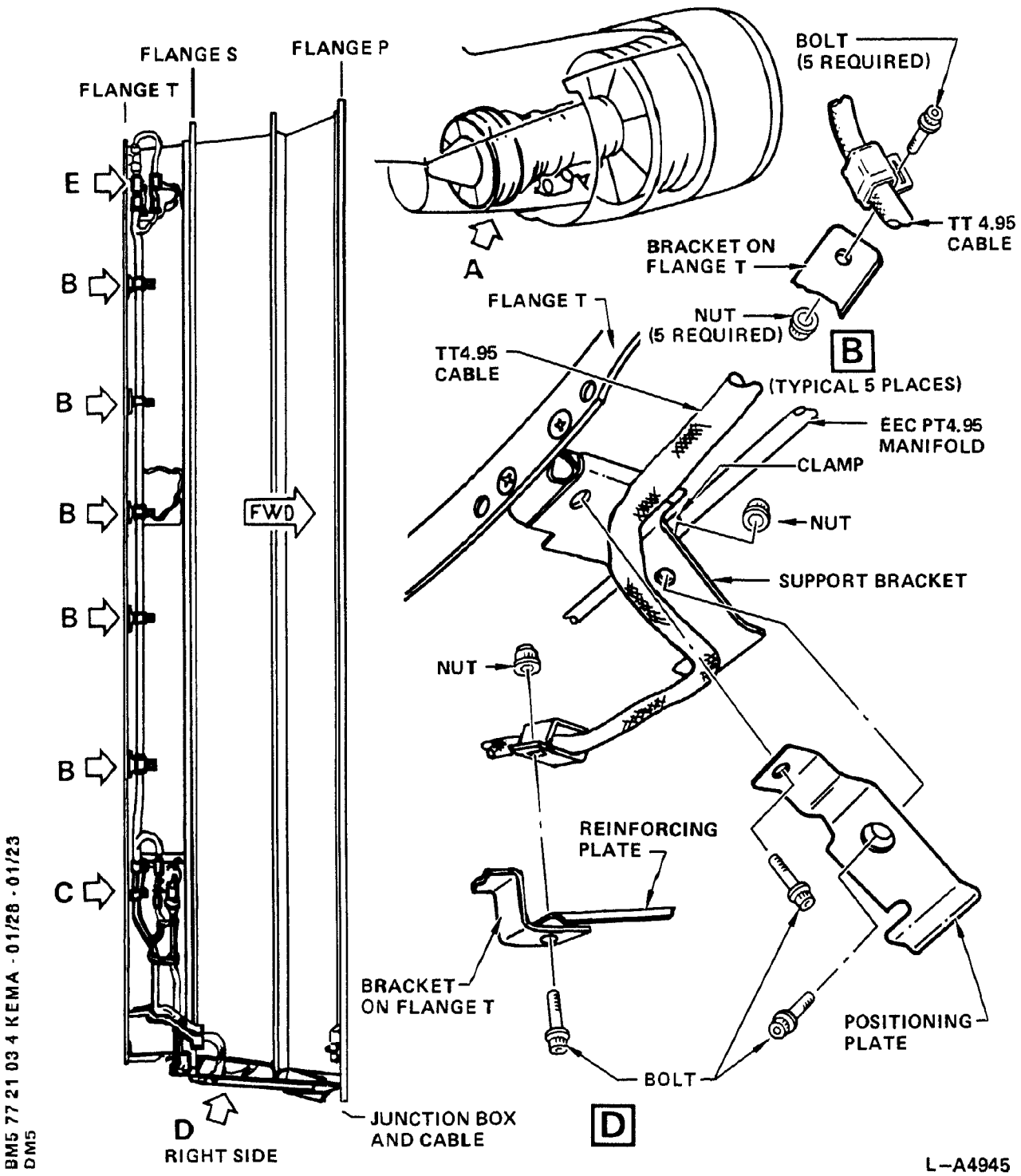
(e)(Post SB PW4ENG 77-20) Remove the nuts from the junction box terminal studs. Connect the W6 cable leads to the studs as follows :

1 Connect averaging circuit leads to thermocouple junction box terminals.

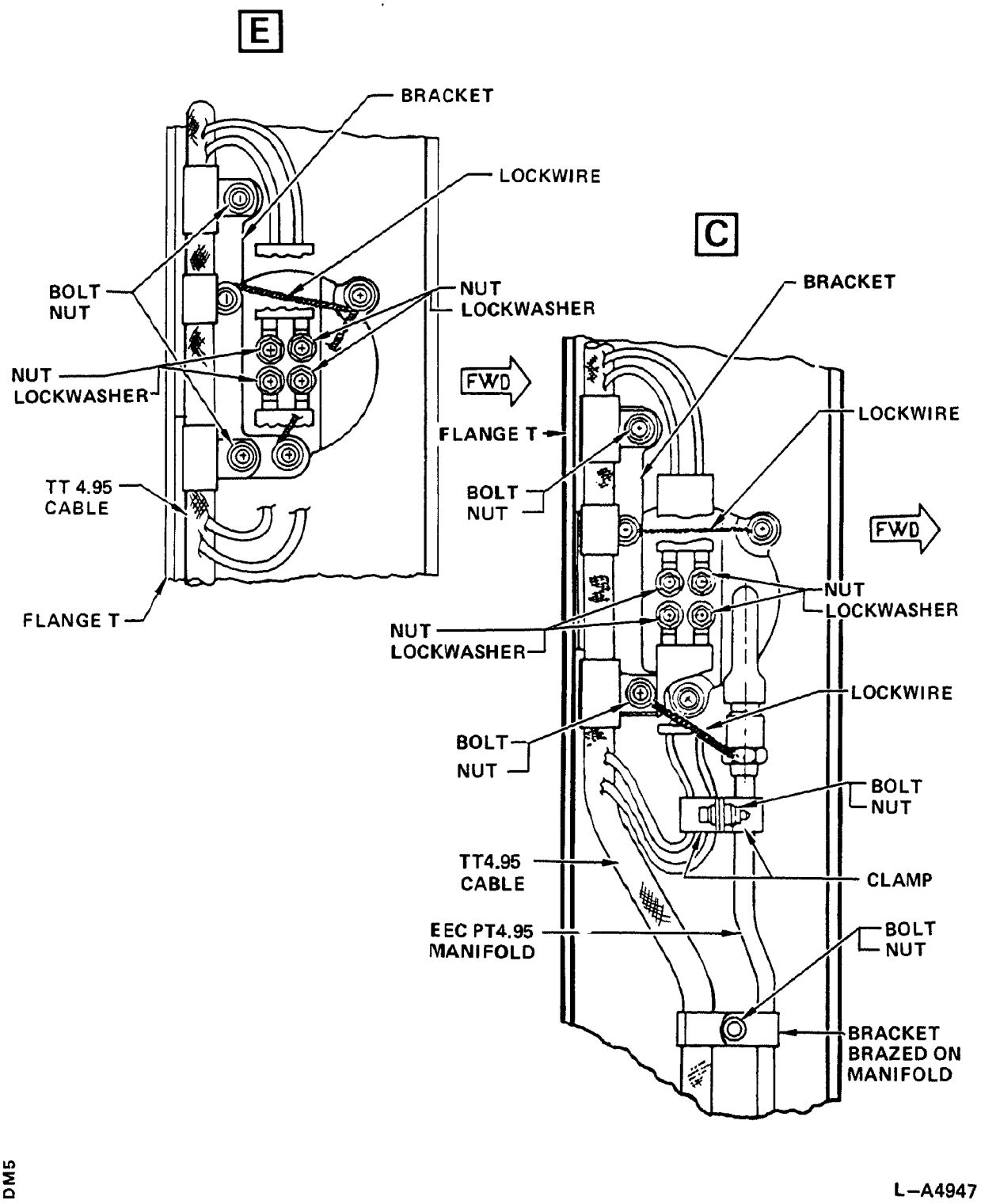
2 Run the nut onto the stud until finger tight so that the locking thread is in contact with the stud thread.

3 Use a torque wrench with a resolution of 1 lbf.in. (0.011 m.daN) or smaller and run-on the nut to the stud as follows :

- minimum run-on torque for the smaller (0.164-32) thread diameter nut shall be 1.5 lbf.in. (0.016 m.daN)
- maximum run-on torque for the smaller (0.164-32) thread diameter nut shall be 9.0 lbf.in. (0.101 m.daN)
- minimum run-on torque for the larger (0.190-32) thread diameter nut shall be 2.0 lbf.in. (0.022 m.daN)
- maximum run-on torque for the larger (0.190-32) thread diameter nut shall be 13.0 lbf.in. (0.14 m.daN).



EGT (TT4.95) Box and Cable Assembly (Post SB PW4ENG 72-134)
Sheet 1/5
Figure 403



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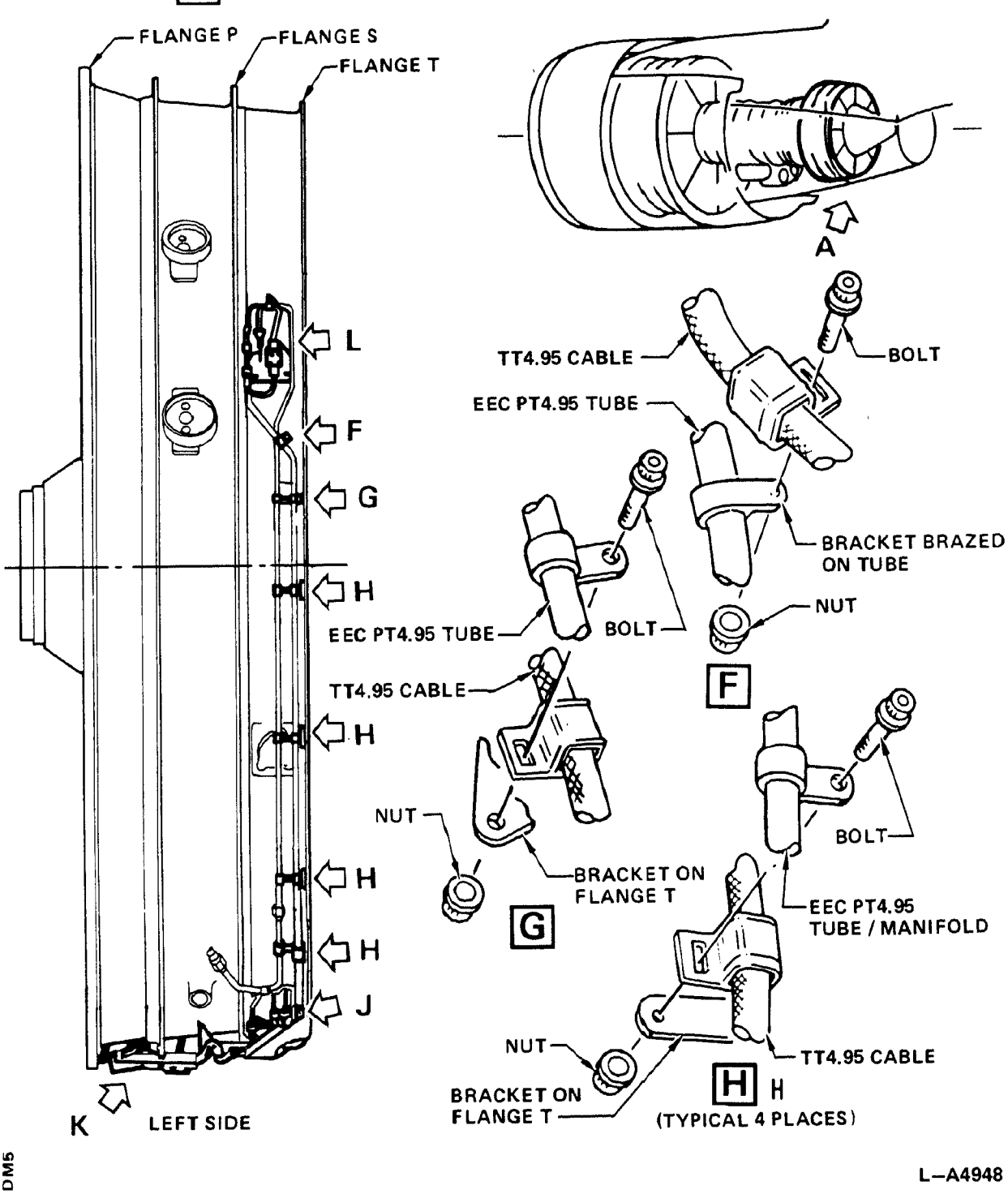
DM5

EGT (TT4.95) Box and Cable Assembly (Post SB PW4ENG 72-134)
Sheet 2/5
Figure 403



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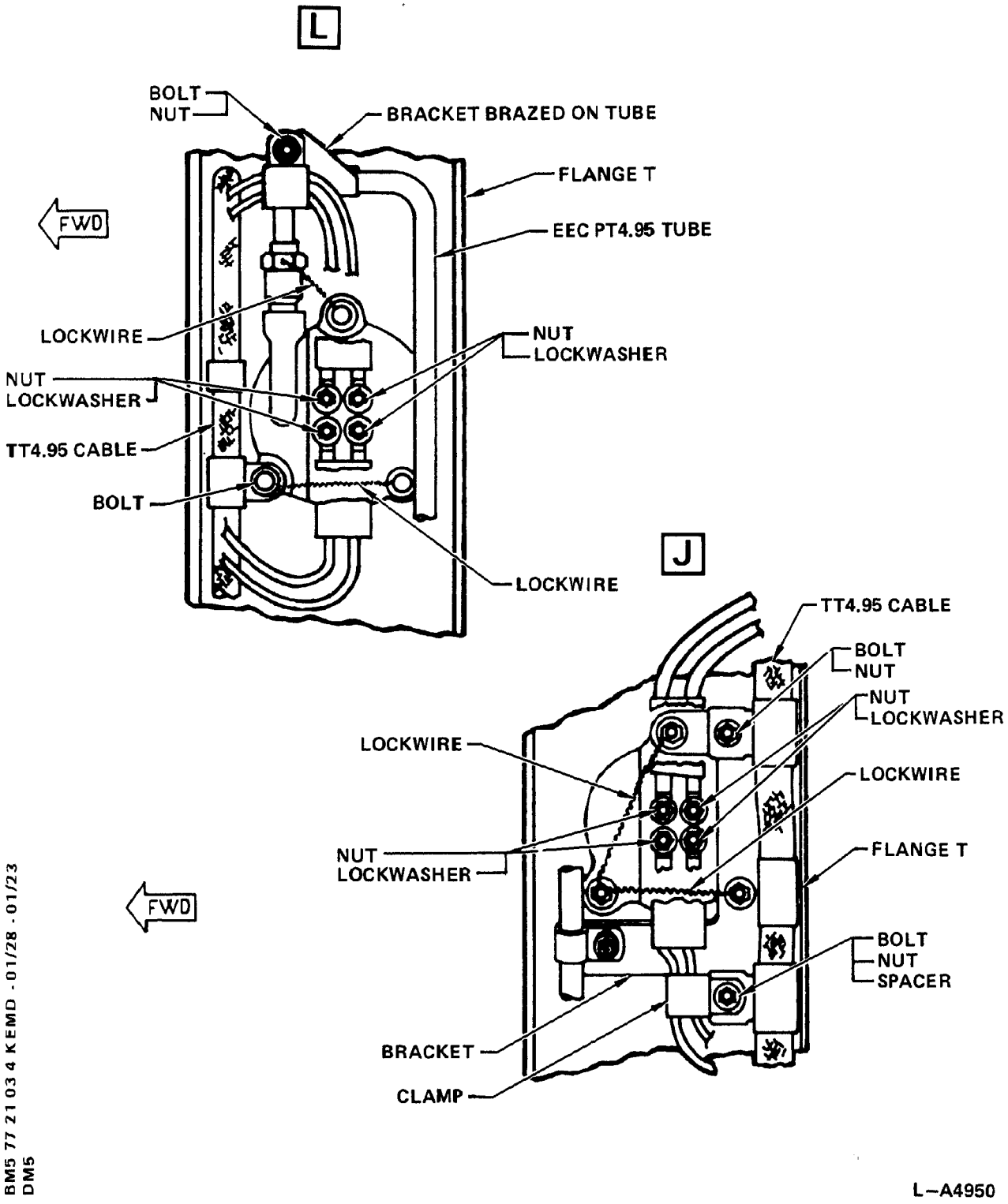
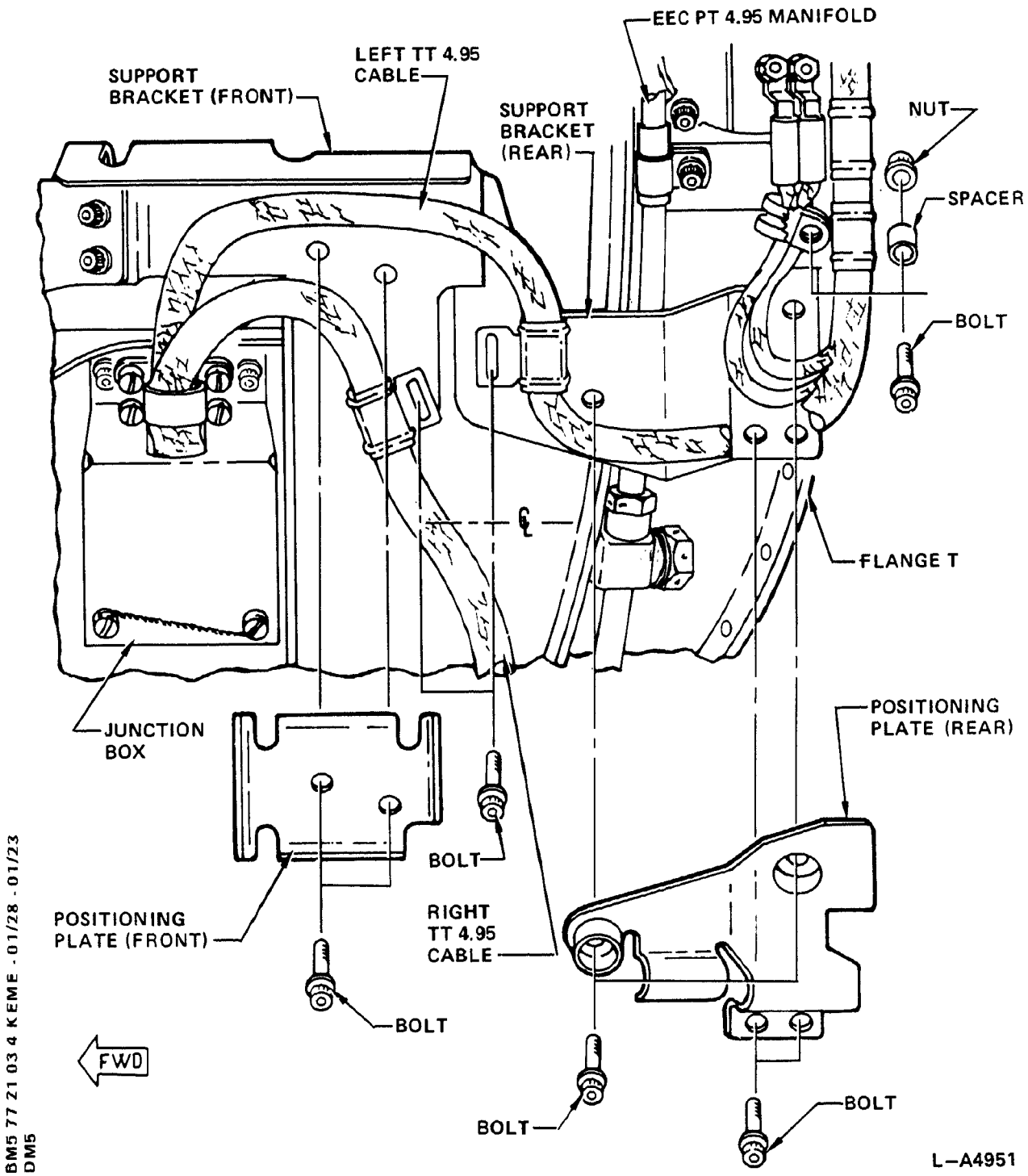
DM5

EGT (TT4.95) Box and Cable Assembly (Post SB PW4ENG 72-134)
Sheet 3/5
Figure 403



BM5 77 21 03 4 KEMD .01/28 .01/23
DM5

EGT (TT4.95) Box and Cable Assembly (Post SB PW4ENG 72-134)
Sheet 4/5
Figure 403



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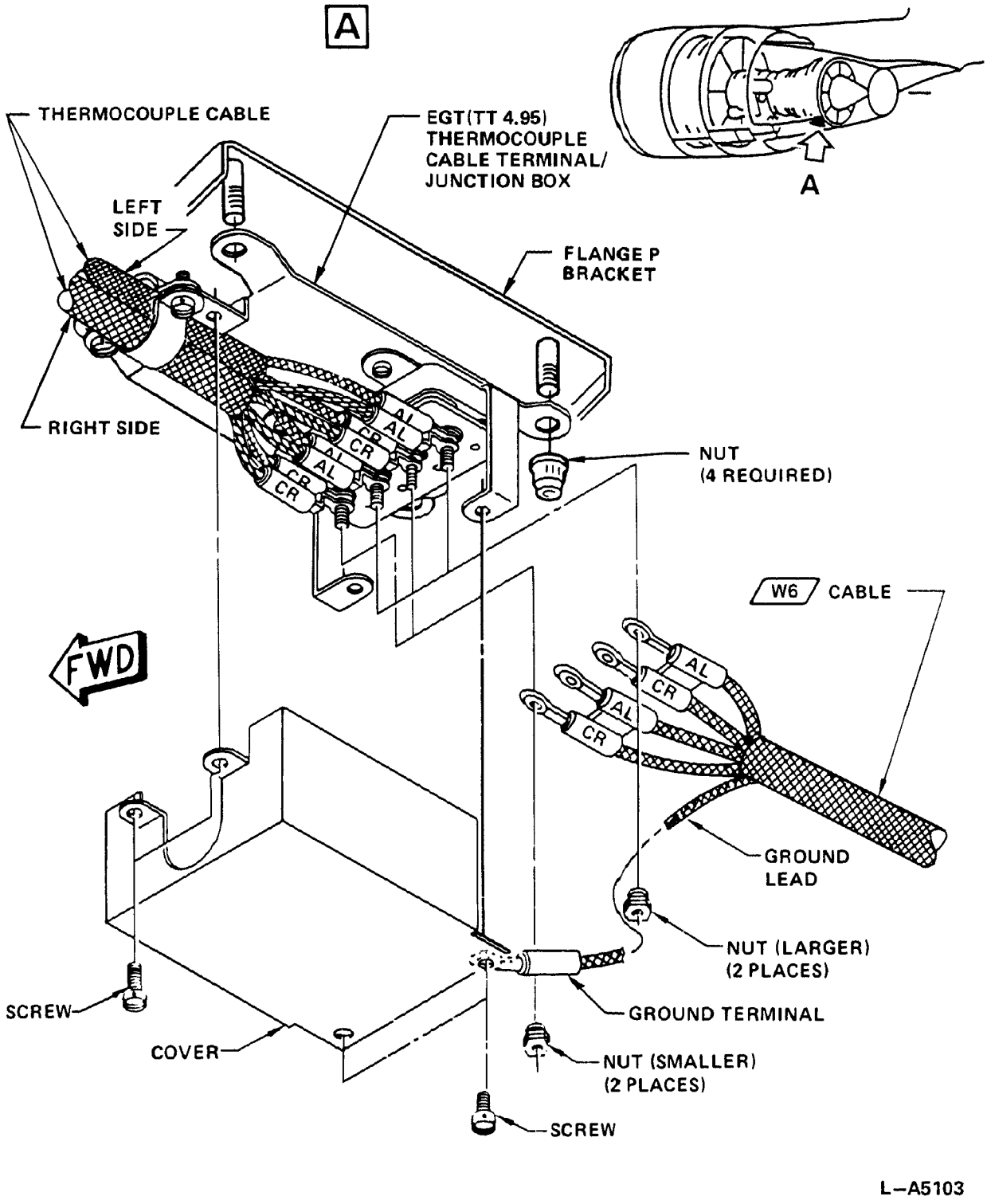
DM5

EGT (TT4.95) Box and Cable Assembly (Post SB PW4ENG 72-134)
Sheet 5/5
Figure 403



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DM5

EGT (TT4.95) Thermocouple Cable (Post SB PW4ENG 72-134)
Junction Box
Figure 404

NOTE : You must perform a run-on test per step (d) to each nut as it is installed.

4 Perform a run-on test as follows :
- use the torque wrench to install the nuts while you measure and record the torque necessary to run the nut down to the stud shoulder
- if any nut fails to meet the minimum or maximum torque requirement, use a new nut and repeat the test
- if a second nut fails to meet the minimum or maximum torque requirement, replace the stud per CMM 77-21-04.

5 TORQUE the larger thread diameter nuts to between 25 and 30 lbf.in. (0.29 and 0.33 m.daN).

6 TORQUE the smaller thread diameter nuts to between 20 and 25 lbf.in. (0.23 and 0.28 m.daN).

(f) Install the cover on the junction box. Put the W6 cable ground lead terminal below the front corner of the cover. Attach the cover and ground terminal with four screws, threads lubricated with Material No.P03-001. TORQUE the screws to between 16 and 22 lbf.in. (0.18 and 0.24m.daN). Install lockwire.

(g) Attach the cable clamps and pressure probe to the exhaust case at the 10 o'clock position with a bolt, threads lubricated with Material No P03-001. TORQUE the bolt to between 75 and 85 lbf.in. (0.84 and 0.96 m.daN). Install lockwire (Ref. Fig. 402).

(h) Install the cable clamps to the brackets adjacent to the thermocouple. Attach the clamps with bolts, threads lubricated with Material No.P03-001, and nuts. TORQUE the bolts to between 36 and 40 lbf.in. (0.40 and 0.45 m.daN) (Ref. Fig. 401) (Sheets 2/4 and 4/4).

(j) Install the cable clamps and the EEC PT4.95 manifold clamps to the brackets on Flange T. Attach the clamps with bolts, threads lubricated with Material No.P03-001, and nuts. TORQUE the bolts to between 36 and 40 lbf.in. (0.40 and 0.45 m.daN). (Ref. Fig. 401) (Sheet 3/4).

(k) Install the cable clamp to the bracket brazed on the EEC PT4.95 manifold. Attach the clamp with bolt, threads lubricated with Material No.P03-001 and nut. TORQUE the bolt to between 36 and 40 lbf.in, (0.40 and 0.45 m.daN) (Ref. Fig. 401) (Sheet 3/4).

(l) Install the cable clamps to the brackets on Flange T at seven locations. Attach the clamps with bolts, threads lubricated with Material No.P03-001, and nuts. TORQUE the bolts to between 36 and 40 lbf.in. (0.40 and 0.45 m.daN) (Ref. Fig. 401) (Sheet 1/4).

(m) Install the outer support bracket to the brackets on Flange P and at the 1 o'clock position. Attach the bracket with bolts, threads lubricated with Material No.P03-001. TORQUE the bolts to between 36 an 40 lbf.in. (0.40 and 0.45 m.daN) (Ref. Fig. 401) (Sheet 4/4).

(n) Install the front and rear inner brackets over the cables and to the outer support bracket. Attach the brackets with bolts, threads lubricated with Material No.P03-001. TORQUE the bolts to between 36 and 40 lbf.in. (0.40 and 0.45 m.daN).

CAUTION : TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(p) Align the thermocouple cable leads attached to the studs on the thermocouple so they are parallel to one another. Torque the nuts at

each thermocouple as follows :

1 TORQUE the alumel connections (larger studs) to between 10 and 15 lbf. in. (0.11 and 0.16 m.daN).

2 TORQUE the chromel connections (smaller studs) to between 8 and 12 lbf.in. (0.09 and 0.13 m.daN).

NOTE : After the nuts are torqued, make sure that the cable leads DO NOT CONTACT the adjacent bolt heads or lockwire.

(2)Install the EGT (TT4.95) box and cable assembly. For engine core with revised TT4.95 cable and PT4.95 sensing manifold for encreased engine core clearance (Post SB PW4ENG 72-134) (Ref. Fig. 403, 404).

(a)Install the box and cable assembly to the bracket on Flange P. Lubricate the threads on the bracket studs with Material No.P03-001, and attach the junction box to the bracket with nuts. TORQUE the nuts to between 32 and 36 lbf.in. (0.36 and 0.40 m.daN).

(b)Remove the nuts and lockwashers from the thermocouple terminal studs at the four thermocouple locations. Install the thermocouple cable leads to the thermocouple studs. Install the lockwashers and nuts (stepped washer face next to the lockwashers) handtight only. (Ref. Fig. 403) (Sheets 2/5 and 4/5).

(c)Remove the lockwire and four screws that attach the cover to the junction box. Remove the cover. (Ref. Fig. 404).

CAUTION : TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

CAUTION : USE OF LUBRICATION IS NOT PERMITTED ON EITHER THE STUDS OR NUTS.

(d)(Pre SB PW4ENG 77-20) Remove the nuts from the junction box terminal studs. Connect the W6 cable leads to the studs. Install the nuts. TORQUE the alumel (larger) nuts to between 18 and 22 lbf.in. (0.20 and 0.24 m.daN). TORQUE the chromel (smaller) nuts to between 15 and 18 lbf.in. (0.16 and 0.20 m.daN).

CAUTION : TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

CAUTION : USE OF LUBRICATION IS NOT PERMITTED ON EITHER THE STUDS OR LOCK NUTS.

CAUTION : ONCE A POST SB PW4ENG 77-20 NUT IS INSTALLED ONTO THE MATING STUD, YOU MUST NOT INSTALL A PRE SB PW4ENG 77-20 NUT ONTO THE STUD.

(e)(Post SB PW4ENG 77-20) Remove the nuts from the junction box terminal studs. Connect the W6 cable leads to the studs as follows :

1 Connect averaging circuit leads to thermocouple junction box terminals.

2 Run the nut onto the stud until finger tight so that the locking thread is in contact with the stud thread.

3 Use a torque wrench with a resolution of 1 lbf.in. (0.011 m.daN) or smaller and run-on the nut to the stud as follows :

- minimum run-on torque for the smaller (0.164-32) thread diameter nut shall be 1.5 lbf.in. (0.016 m.daN)
- maximum run-on torque for the smaller (0.164-32) thread diameter nut shall be 9.0 lbf.in. (0.101 m.daN)

- minimum run-on torque for the larger (0.190-32) thread diameter nut shall be 2.0 lbf.in. (0.022 m.daN)
- maximum run-on torque for the larger (0.190-32) thread diameter nut shall be 13.0 lbf.in. (0.14 m.daN).

NOTE : You must perform a run-on test per step (d) to each nut as it is installed.

4 Perform a run-on test as follows :
- use the torque wrench to install the nuts while you measure and record the torque necessary to run the nut down to the stud shoulder
- if any nut fails to meet the minimum or maximum torque requirement, use a new nut and repeat the test
- if a second nut fails to meet the minimum or maximum torque requirement, replace the stud per CMM 77-21-04.

5 TORQUE the larger thread diameter nuts to between 25 and 30 lbf.in. (0.29 and 0.33 m.daN).

6 TORQUE the smaller thread diameter nuts to between 20 and 25 lbf.in. (0.23 and 0.28 m.daN).

(f) Install the cover on the junction box. Put the W6 cable ground lead terminal below the rear corner of the cover. Attach the cover and ground terminal with four screws, threads lubricated with Material No.P03-001. TORQUE the screws to between 16 and 22 lbf.in. (0.18 and 0.74 m.daN). Install lockwire.

(g) Attach the cable clamp and pressure probe to the exhaust case at the 10 o'clock position with a bolt, threads lubricated with Material No.P03-001. TORQUE the bolt to between 75 and 85 lbf.in. (0.84 and 0.96 m.daN). Install lockwire. (Ref. Fig. 403) (Sheet 4/5).

(h) Clamp the top two thermocouple leads at the 10 o'clock thermocouple to the bracket brazed on the EEC PT4.95 tube. Attach the clamp with bolt, threads lubricated with Material No.P03-001, and a nut. TORQUE the bolt to between 36 and 40 lbf.in. (0.40 and 0.45 m.daN) (Ref. Fig. 403) (Sheet 4/5).

(j) Install the cable clamps to the brackets adjacent to the thermocouple. Attach the clamps with bolts, threads lubricated with Material No.P03-001, and nuts. TORQUE the bolts to between 36 and 40 lbf.in. (0.40 and 0.45 m.daN) (Ref. Fig. 403) (Sheet 2/5).

(k) Install the cable clamps and the EEC PT4.95 tube manifold clamps to the brackets on Flange T at five locations. Attach the clamps with bolts, threads lubricated with Material No.P03-001, and nuts. TORQUE the bolts to between 0.36 and 0.40 lbf.in. (0.40 and 0.45 m.daN) (Ref. Fig. 403) (Sheet 3/5).

(l) Install the cable clamps to the brackets on Flange T at five locations. Attach the clamps with bolts, threads lubricated with Material No.P03-001, and nuts. TORQUE the bolts to between 36 and 40 lbf.in. (0.40 and 0.45 m.daN) (Ref. Fig. 403) (Sheet 1/5).

(m) Install the cable clamp to the bracket brazed on the EEC PT4.95 manifold at the 4:30 o'clock position. Attach the clamp with bolt, threads lubricated with Material No.P03-001, and nut. TORQUE the bolt to between 36 and 40 lbf.in. (0.40 and 0.45 m.daN) (Ref. Fig. 403) (Sheet 2/5).

(n) Clamp the bottom two thermocouple leads at the 4:30 o'clock thermocouple to the EEC PT4.95 manifold, 1/2 inch (12.700 mm) from the

manifold nut. Attach the leads with two clamps, bolt, threads lubricated with Material No.P03-001, and a nut. TORQUE the nut to between 36 and 40 lbf.in. (0.40 and 0.45 m.daN) (Ref. Fig. 403) (Sheet 2/5).

(p) Install the cable clamp to the bracket brazed on the EEC PT4.95 tube. Attach the clamp with bolt, threads lubricated with Material No.P03-001, and nut. TORQUE the bolt to between 36 and 40 lbf.in. (0,40 and 0.45 m.daN) (Ref. Fig. 403) (Sheet 3/5).

(q) Install the cable clamps, and a clamp on the botton two thermocouple leads, to the bracket adjacent to the thermocouple at the 1 o'clock position. Attach the clamps with bolts, threads lubricated with Material No.P03-001, nuts and spacer. Install the spacer between the lead clamp and the cable clamp. TORQUE the bolt to between 36 and 40 lbf.in. (0.40 and 0.45 m.daN) (Ref. Fig. 403) (Sheet 4/5).

(r) Make a loop in the thermocouple cable adjacent to the 1 o'clock thermocouple. Attach the cable clamp, nearest to the loop, to the rear support bracket with a bolt, threads lubricated with Material No.P03-001. TORQUE the bolt to between 36 and 40 lbf.in. (0.40 and 0.45 m.daN) (Ref. Fig. 403) (Sheet 5/5).

(s) Install the rear positioning plate with the rear spacer inside the cable/thermocouple lead loop and the front spacer inside the cable adjacent to the cable clamp. Attach the positioning plate to the rear support bracket with four bolts, threads lubricated with Material No.P03-001. TORQUE the bolts to between 36 and 40 lbf.in. (0.40 and 0.45 m.daN) (Ref. Fig. 403) (Sheet 5/5).

(t) Make a loop in the thermocouple cable adjacent to the junction box. Attach the cable clamp, nearest to the loop, to the front support bracket with a bolt, threads lubricated with Material No.P03-001. TORQUE the bolt to between 36 and 40 lbf.in. (0.40 and 0.45 m.daN) (Ref. Fig. 403) (Sheet 5/5).

(u) Install the front positioning plate on the two cables with the spacers, inboard, between the cables. Attach the plate to the front support bracket with two bolts, threads lubricated with Material No.P03-001. TORQUE the bolts to between 36 and 40 lbf.in. (0.40 and 0.45 m.daN) (Ref. Fig. 403) (Sheet 5/5).

NOTE : The cables installed below the positioning plate will be compressed by the plate when torquing the bolts.

(v) Install the positioning plate on the thermocouple cable at approximately the 5 o'clock position. Install the cable to the left of the inner spacer and to the right of the outer spacer on the plate. Attach the positioning plate and the clamp on the EEC PT4.95 manifold to the support bracket with two bolts, threads lubricated with Material No.P03-001, and nut. TORQUE the bolts to between 36 and 40 lbf.in. (0.40 and 0.45 m.daN) (Ref. Fig. 403) (Sheet 1/5).

NOTE : The cable installed below the positioning plate will be compressed by the plate when torquing the bolts.

(w) Install the cable clamp to the inboard side of the reinforcing plate at the 5:30 o'clock position. Attach the clamp to the plate with a bolts, threads lubricated with Material No.P03-001, and a nut. TORQUE the bolt to between 36 and 40 lbf.in. (0.40 and 0.45 m.daN) (Ref. Fig. 403) (Sheet 1/5).

CAUTION : TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(x) Align the thermocouple cable leads attached to the studs on the thermocouple so they are parallel to one another. Torque the nuts at each thermocouple as follows :

1 TORQUE the alumel connections (larger studs) to between 10 and 15 lbf.in. (0.11 and 0.16 m.daN).

2 TORQUE the chromel connections (smaller studs) to between 8 and 12 lbf.in. (0.09 and 0.13 m.daN).

NOTE : After the nuts are torqued, make sure that the cable leads DO NOT CONTACT the adjacent bolt heads or lockwire.

R D. Removal of Damaged Stud(s) From Thermocouple Junction Box (Ref. Fig. 405)

R (1) Cut safety wire and remove from the four screws. Discard the safety wire.

R (2) Use a flat head screwdriver to remove the four screws which hold the mounting plate to the base plate.

R (3) Cut safety wire and remove from the eight screws. Discard the safety wire.

R (4) Use a flat head screwdriver to remove the eight screws which hold the retainer plate to the mounting plate.

R (5) Remove the retainer plate from the mounting plate.

R NOTE : Hold the retainer up and the mounting plate down to prevent the stud from falling out.

R (6) Remove the damaged square stud(s) from the mounting plate.

R E. Installation of Replacement Stud(s) in the Thermocouple Junction Box (Ref. Fig. 405)

R (1) Install the new square stud(s) in the correct location(s) in the mounting plate.

R (2) Put the retainer plate on the square stud assemblies.

R (3) Install eight screws, threads lubricated with Engine Oil (Material No.P03-001), to the mounting plate to attach the retainer plate to the mounting plate.

R (4) Use a flat head screwdriver to tighten the eight screws that attach the retainer plate to the mounting plate. TORQUE screws to between 8.5 and 10 lbf.in. (0.097 and 0.112 m.daN) and lockwire.

R (5) Put the mounting plate to the base plate with four screws, threads lubricated with Engine Oil (Material No.P03-001).

R (6) Use a flat head screwdriver to tighten the four screws that attach the mounting plate to the base plate. TORQUE screws to between 16 and 20 lbf.in. (0.181 and 0.225 m.daN) and lockwire.

R F. Close-Up and Test

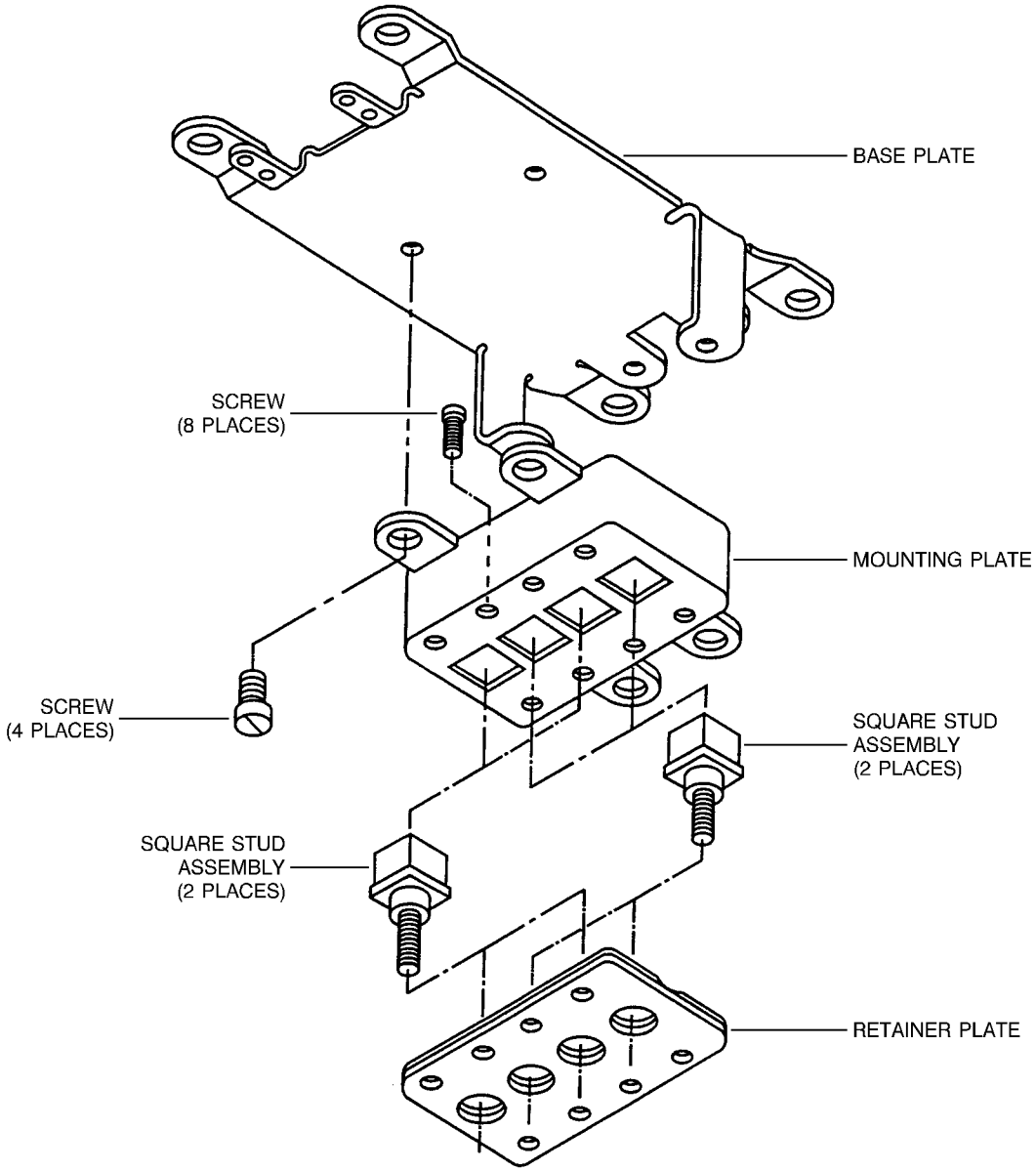
(1) Make certain that working area is clean and clear of tools and miscellaneous items of equipment.

(2) Remove access platform.

(3) Remove safety clips and tags and close circuit breakers : 35KS, 37KS, 34KS, 36KS.

(4) Close thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301).

(5) Test engine per Test Reference Table (Ref. 71-00-00, P. Block 501).



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L-D3031 (0705)
PW V

EGT (TT4.95) Thermocouple Cable Junction Box Stud Replacement
Figure 405

EGT (TT4.95) BOX AND CABLE - ADJUSTMENT/TEST

1. Test EGT (TT4.95) Box and Cable

A. General

Validity of electrical tests made in field may depend upon limitations inherent in common ohmmeter. This instrument is not dependable for determining exact wire resistances of thermocouple box and cable. It may, however, be used to detect gross failures such as open or intermittent circuits, and metal-to-metal short circuits. Also, approximate insulation resistance may be checked if certain precautions are observed. Ohmmeter used in following tests must be of good quality and in good condition ; i.e free from "stickiness" of meter needle, with pin-jacks firm, test leads sound, and dry cells in condition to permit full scale deflection for all positions of range switch.

B. Equipment and Materials

ITEM	DESIGNATION
(1)	Circuit Breaker Safety Clips
(2)Material No.P03-001	Oils (Ref. 70-00-00)
(3)	Corrosion Resistant Steel Lockwire (MS9226-03) (Ref. 70-00-00)
(4)	Torque Wrench
Referenced Procedures	
- 71-00-00, P. Block 501	Power Plant - General
- 71-13-00, P. Block 301	Cowl Doors

C. Procedure (Ref. Fig. 501, 502)

R (1)Job Set-Up

R (a)Install access platform.

R (b)Open, safety and tag the following circuit breakers :

PANEL	SERVICE	IDENT.	LOCATION
FOR ENGINE 1			
133VU	ENG1/SCU SUPPLY GND	35KS	333/T76
133VU	ENG1/SCU SUPPLY FLT	37KS	333/T75
FOR ENGINE 2			
133VU	ENG2/SCU SUPPLY GND	34KS	333/T85
133VU	ENG2/SCU SUPPLY FLT	36KS	333/T84

R (c)Open fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

(2)Prepare cable for test

(a)Tag all thermocouple cable leads to ensure proper reinstallation.

NOTE : Nut and stud diameters of alumel terminals are larger than those of chromel terminals.

(b)Remove nuts and lockwashers from probe stud terminals and remove cable leads.

(c)Remove bolts attaching junction box cover to junction box and remove

covers.

(d)Disconnect averaging circuit leads from junction box terminals (Circuit A and Circuit B). Each circuit has two pairs of leads and a shield. Separate each pair in each circuit and label.

(3)Continuity check

(a)Set ohmmeter range switch to range which has center scale value of approximately 10 ohms.

NOTE : Broken wires which come into contact intermittently due to flexing will cause needle to fluctuate. False intermittent indications will result if ohmmeter prods are not in firm contact with clean terminals ; also, if ohmmeter prods, leads, or jack are defective.

(b)Perform continuity check per referenced schematic.

(c)Reject any assembly for discontinuity.

(4)Check insulation resistance

(a)Using low voltage ohmmeter, check insulation for short circuits, excessive leakage, and internal insulation chafing discrepancies. Check proper operation of instrument by touching test prods together and noting needle deflection to read zero ohms.

NOTE : Low voltage ohmmeter utilizing less than 40 volts (DC) and maintained at accuracy of five percent shall be used for determining insulation resistance.

(b)Place one prod in contact with cable steel braid covering and other prod in contact, respectively, with following junction box studs. (Ref. Fig. 501)

1 Alumel, T/C 3 and T/C 4, Circuit A
2 Alumel, T/C 2 and T/C 1, Circuit A
3 Chromel, T/C 5 and T/C 4, Circuit A
4 Chromel, T/C 2 and T/C 1, Circuit A

(c)Repeat step (b) for Circuit B.

R (d)Read ohmmeter. If resistance recorded is below 50,000 ohm, proceed as follows : If full-scale deflection (zero ohms) is recorded and no terminals are in accidental contact, reject part. If larger (but not full-scale) deflection is recorded, presence of carbon or excessive moisture may be indicated. Carbon yields fairly steady reading. Moisture tends to produce readings which waver or drift after 5 - 30 seconds. If presence of moisture is indicated, bake cable at 220° - 250°F (104° - 121° C) for one hour and recheck.

NOTE : False drift may be due to variations in applied voltage. To check for false drift, place prods in contact with each other for ten seconds. Readings must not wander from full-scale deflection.

(e)Perform resistance check of insulation between conductors using low voltage ohmmeter. Place one prod on the alumel Circuit A output stud and the other prod on the chromel Circuit A output stud. If

R resistance recorded is below 50,000 ohms, reject part.

(f)Repeat step (e) for Circuit B.

(5)Short circuit check

(a)Set ohmmeter range switch to range which has center scale value of approximately 10 ohms.

(b)Place prods respectively as described in steps (4) (b), (c), (e) and

(f). Flex cable gently along entire length of conductors under test and observe instrument needle. If any deflection results (unless caused by accidental contact between other terminals of cable), reject part.

(6)Defective or rejected thermocouple box and cable falls into three basic categories.

(a)No continuity in circuit.

(b)Shorted circuit.

(c)Low insulation resistance.

CAUTION : TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

CAUTION : USE OF LUBRICATION IS NOT PERMITTED ON EITHER THE STUDS OR NUTS.

(7)(Pre SB PW4ENG 77-20) Restore to pretest configuration.

(a)Connect averaging circuit leads to thermocouple junction box terminals. TORQUE chromel (smaller) nuts on terminals to between 15 and 18 lbf.in. (0.17 and 0.20 m.daN). TORQUE alumel (larger) nuts on terminals to between 18 and 22 lbf.in. (0.20 and 0.24 m.daN).

(b)Position junction box cover on junction box, install attaching bolts and lockwire.

(c)Position thermocouple cable leads on probe stud terminals, install lockwashers and nuts. TORQUE chromel (smaller) nuts on terminals to between 8 and 12 lbf.in. (0.09 and 0.13 m.daN). TORQUE alumel (larger) nuts on terminals to between 10 and 15 lbf.in. (0.11 and 0.17 m.daN).

CAUTION : TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

CAUTION : USE OF LUBRICATION IS NOT PERMITTED ON EITHER THE STUDS OR LOCK NUTS.

CAUTION : ONCE A POST SB PW4ENG 77-20 NUT IS INSTALLED ONTO THE MATING STUD, YOU MUST NOT INSTALL A PRE SB PW4ENG 77-20 NUT ONTO THE STUD.

(8)(Post SB PW4ENG 77-20) Restore to pretest configuration.

(a)Connect averaging circuit leads to thermocouple junction box terminals.

(b)Run the nut onto the stud until finger tight so that the locking thread is in contact with the stud thread.

(c)Use a torque wrench with a resolution of 1 lbf.in. (0.011 m.daN) or smaller and run-on the nut to the stud as follows :

- minimum run-on torque for the smaller (0.164-32) thread diameter nut shall be 1.5 lbf.in. (0.016 m.daN)
- maximum run-on torque for the smaller (0.164-32) thread diameter nut shall be 9.0 lbf.in. (0.101 m.daN)
- minimum run-on torque for the larger (0.190-32) thread diameter nut shall be 2.0 lbf.in. (0.022 m.daN)
- maximum run-on torque for the larger (0.190-32) thread diameter nut shall be 13.0 lbf.in. (0.14 m.daN).

NOTE : You must perform a run-on test per step (d) to each nut as it is installed.

(d)Perform a run-on test as follows :

- use the torque wrench to install the nuts while you measure and record the torque necessary to run the nut down to the stud shoulder

- if any nut fails to meet the minimum or maximum torque requirement, use a new nut and repeat the test
- if a second nut fails to meet the minimum or maximum torque requirement, replace the stud per CMM 77-21-04.

(e)TORQUE the larger thread diameter nuts to between 25 and 30 lbf.in. (0.29 and 0.33 m.daN).

(f)TORQUE the smaller thread diameter nuts to between 20 and 25 lbf.in. (0.23 and 0.28 m.daN).

(g)Position junction box cover on junction box, install attaching bolts and lockwire.

(h)Position thermocouple cable leads on probe stud terminals, install lockwashers and nuts. TORQUE chromel (smaller) nuts on terminals to between 8 and 12 lbf.in. (0.10 and 0.13 m.daN). TORQUE alumel (larger) nuts on terminals to between 10 and 15 lbf.in. (0.12 and 0.16 m.daN).

R (9)Close-up and test

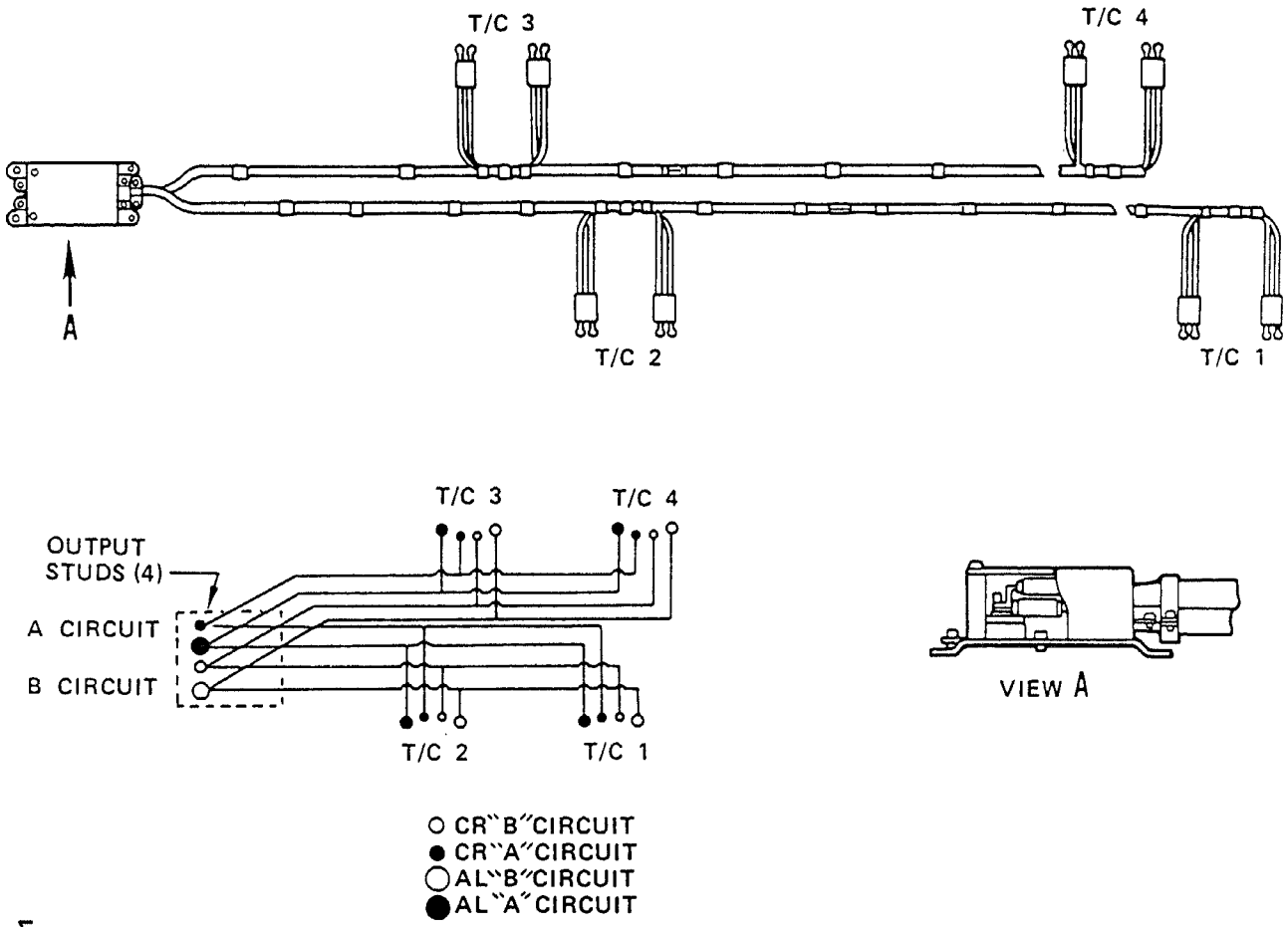
R (a)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.

R (b)Remove access platform.

R (c)Remove safety clips and tags and close circuit breakers : 35KS, 37KS, 34KS, 36KS.

R (d)Close thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301).

R (e)Test engine per Test Reference Table (Ref. 71-00-00, P. Block 501).



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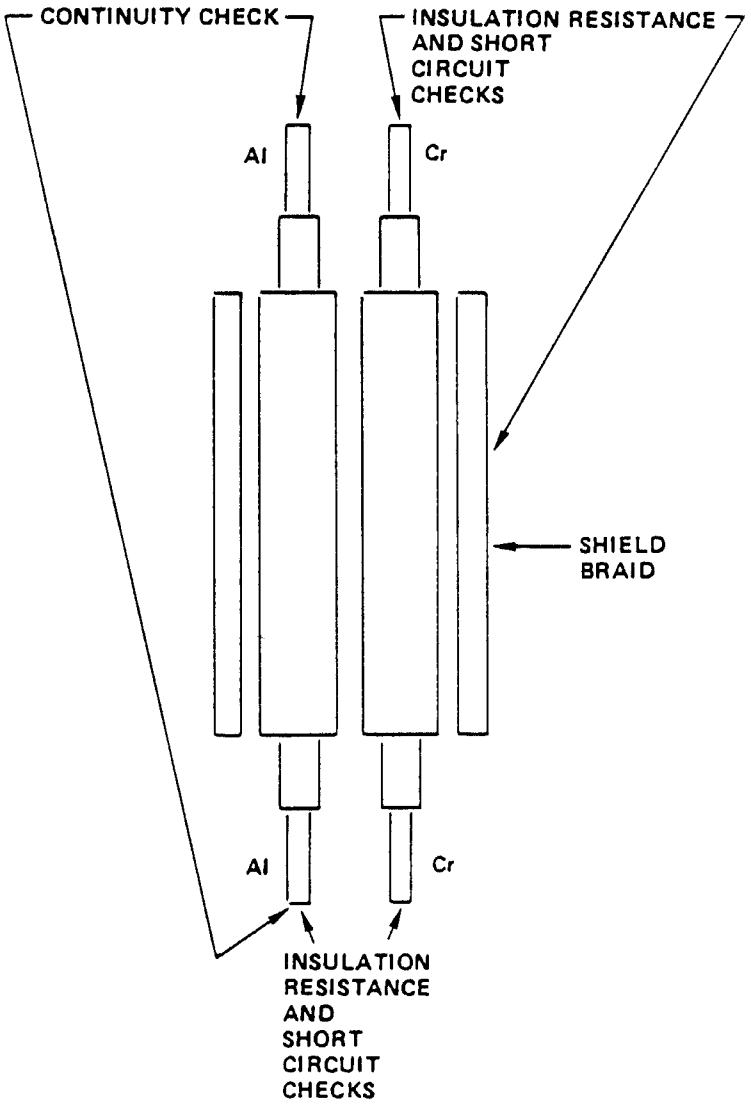
Test Schematic
Figure 501



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Cable Test
Figure 502

EGT (TT4.95) BOX AND CABLE - INSPECTION/CHECK

1. Equipment and Materials

ITEM	DESIGNATION
A.	Access Platform
B.	Circuit Breaker Safety Clips
Referenced Procedures	
- 71-13-00, P. Block 301	Cowl Doors
- 71-00-00, P. Block 501	Power Plant - General

2. Procedure

A. Job Set-Up
(1)Open, safety and tag the circuit breakers for the appropriate engine and open fan cowl and thrust reverser doors (Ref. 71-13-00, P. Block 301).
(2)Install access platform.

B. Inspection
(1)Check EGT box and cable for evidence of damage to steel braid and to terminals.
(2)Defective or rejected box and cable fall into two basic categories.
(a)Damaged or frayed braid.
(b)Damaged or broken terminals and/or brackets.
NOTE : Replace left or right termocouple cable, as required.

C. Close-Up
(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(2)Remove access platform.
(3)Remove safety clips and tags and close circuit breakers, close thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301).
(4)Test engine per Test Reference Table (Ref. 71-00-00, P. Block 501).

EGT (TT4.95) BOX AND CABLE - CLEANING/PAINTING

1. Equipment and Materials

ITEM	DESIGNATION
A.	Access Platform
B.	Circuit Breaker Safety Clips
Referenced Procedures	
- 70-00-00, P. Block 201	Engine - Standard Practices
- 71-13-00, P. Block 301	Cowl Doors

2. Procedure

A. Job Set-Up
(1) Open, safety and tag circuit breakers for the appropriate engine and open fan cowl and thrust reverser doors (Ref. 71-13-00, P. Block 301).
(2) Install access platform.

B. Cleaning
(1) Clean external surfaces by wiping with a cloth slightly dampened with a cleaner solvent (Ref. 70-00-00, P. Block 201), SPOP 208.
CAUTION : LEAVE NO FOREIGN MATERIAL ON TERMINALS.
(2) If necessary, clean thermocouple harness and lead alumel and chromel terminal lugs using a stainless steel brush or stainless steel pad (without soap).
CAUTION : IMBEDDED STAINLESS STEEL PARTICLES MAY ADVERSELY AFFECT THE ACCURACY OF LOW LEVEL MILLIVOLT EGT SIGNALS, THEREFORE, ENSURE THAT ALL FOREIGN MATERIAL IS REMOVED FROM THE TERMINALS.
(3) Remove residue using clean compressed air at 30 psig (2.07 bars) maximum discharge pressure.

C. Close-Up
(1) Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(2) Remove access platform.
(3) Remove safety clips and tags and close circuit breakers, close thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301).

R EGT THERMOCOUPLE (TT 4.95) - REMOVAL/INSTALLATION

1. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Access Platform
C.	Corrosion Resistant Steel Lockwire (AS3214-02) (Ref. 70-00-00)
D.	Torque Wrench
E. Material No.P03-001	Oils (Ref. 70-00-00)
F. Material No.P06-023	Lubricants (Ref. 70-00-00)
G.	Protective Cap
Referenced Procedures	
- 71-00-00, P. Block 501	Power Plant - General
- 71-13-00, P. Block 301	Cowl Doors

2. Procedure

A. Job Set-Up
(1)Open, safety and tag the following circuit breakers :

PANEL	SERVICE	IDENT.	LOCATION
FOR ENGINE 1			
133VU	ENG1/SCU SUPPLY GND	35KS	333/T76
133VU	ENG1/SCU SUPPLY FLT	37KS	333/T75
FOR ENGINE 2			
133VU	ENG2/SCU SUPPLY GND	34KS	333/T85
133VU	ENG2/SCU SUPPLY FLT	36KS	333/T84

(2)Install access platform.
(3)Open fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

B. Removal (Pre SB PW4 ENG 72-134) (Ref. Fig. 401)
(1)Remove four nuts and washers securing cable to thermocouple connections. Remove cable ends from thermocouple.
(2)Remove thermocouple at Location A (10 o'clock position).
(a)Remove lockwire and disconnect PT4.95 manifold from pressure probe. Loosen clamp bolts attaching manifold to Flange T brackets as required to gain clearance for thermocouple removal.
(b)Remove lockwire and two bolts securing thermocouple to housing and exhaust case. Remove thermocouple.
(3)Remove thermocouple at Location B (7 o'clock position).
(a)Remove bolt and nut securing PT4.95 manifold to bracket.
(b)Remove lockwire and two bolts securing thermocouple and bracket to housing and exhaust case. Move bracket rearward and remove thermocouple.
(4)Remove thermocouple from Locations C and D (1 o'clock and 4 o'clock positions).

(a)Remove lockwire and two bolts (each location) securing thermocouple and bracket to housing and exhaust case. Move bracket rearward and remove thermocouple.

(5)Install protective closures.

C. Installation (Pre SB PW4 ENG 72-134) (Ref. Fig. 401)

(1)Remove protective closures.

(2)Install thermocouple at Location H (10 o'clock position).

(a)Insert thermocouple into housing and case aligning bolt holes. Secure in place with bolts, threads lubricated with Material No.P06-023. TORQUE bolts to between 54 and 60 lbf.in. (0.61 and 0.68 m.daN) and wirelock.

CAUTION : DO NOT USE LUBRICANTS ON FADEC SENSING TUBES, ADAPTERS, OR PACKINGS. CONTAMINATION OF FADEC CAN RESULT.

(b)Install PT4.95 manifold nut to probe adapter. TORQUE manifold nut to between 135 and 150 lbf.in. (1.52 and 1.69 m.daN) and wirelock.

(c)TORQUE clamp bolts loosened as required to between 36 and 40 lbf.in. (0.41 and 0.45 m.daN).

(3)Install thermocouple at Location B (7 o'clock position).

(a)Insert thermocouple into housing and case aligning bolt holes. Align bracket and secure with two bolts, threads lubricated with Material No.P06-023.
TORQUE bolts to between 54 and 60 lbf.in. (0.61 and 0.68 m.daN) and wirelock.

(b)Install bolt, threads lubricated with Material No.P03-001, and nut securing PT4.95 manifold clamp to bracket. TORQUE clamp bolt to between 36 and 40 lbf.in. (0.41 and 0.45 m.daN).

(4)Install thermocouple at Locations C and D (1 o'clock and 4 o'clock positions).

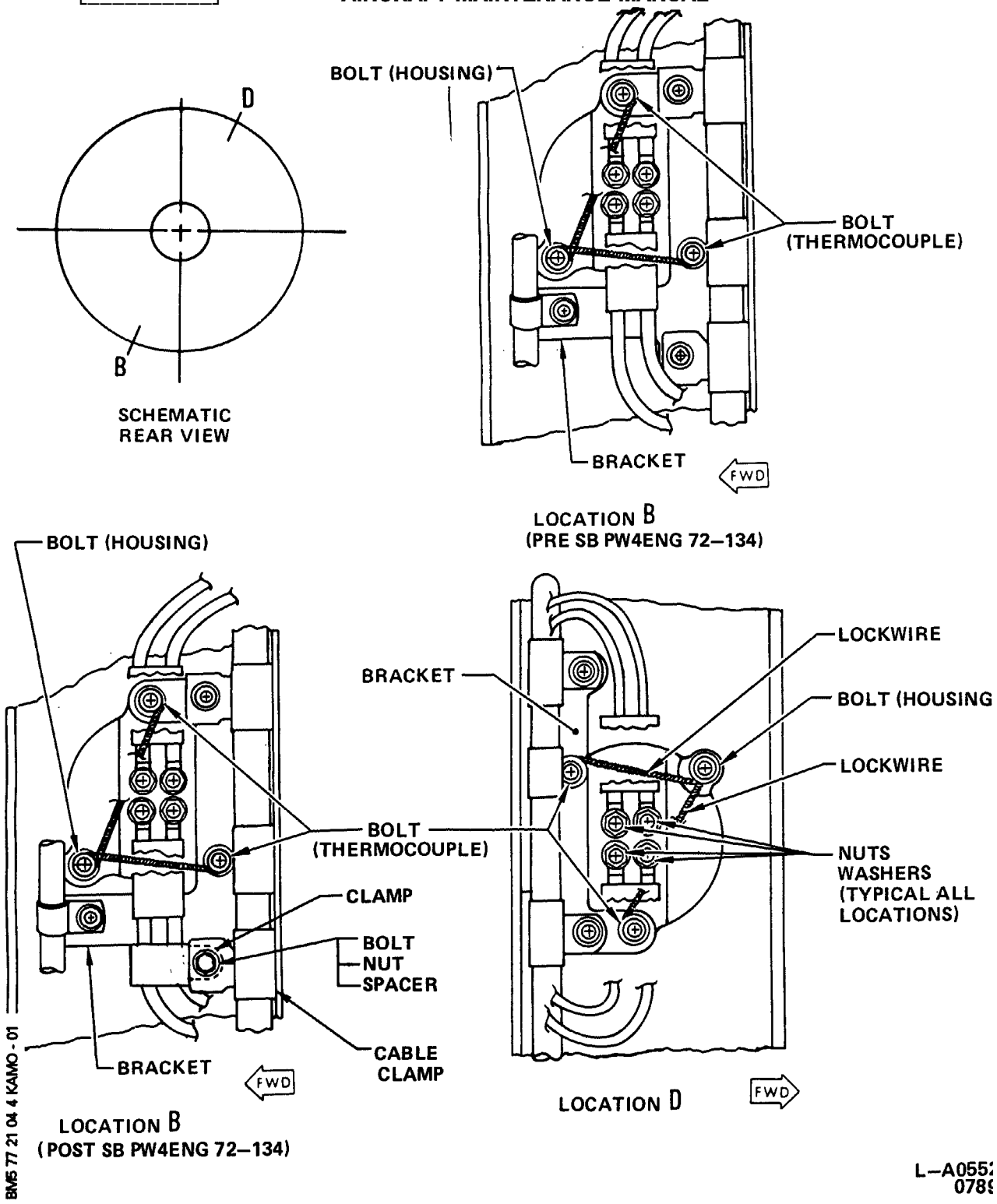
(a)Insert thermocouple(s) into housing and case aligning bolt holes. Align bracket and secure with bolts, threads lubricated with Material No.P06-023. TORQUE bolts to between 54 and 60 lbf.in. (0.61 and 0.68 m.daN) and wirelock.

CAUTION : TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(5)Connect thermocouple cable leads to thermocouples.
Secure with washers and nuts and torque thermocouple nuts.

(a)TORQUE alumel connections (larger studs) to between 10 and 15 lbf.in. (0.11 and 0.17 m.daN).

(b)TORQUE chromel connections (smaller studs) to between 8 and 12 lbf.in. (0.10 to 0.13 m.daN).



Exhaust Gas Temperature Thermocouple
(Pre SB PW4 ENG 72-134)
Figure 401

D. Removal (Post SB PW4 ENG 72-134) (Ref. Fig. 402)
(1)Remove four nuts and washers that attach the thermocouple wires to the thermocouple connections. Remove the thermocouple connectors from thermocouple.
(2)Remove the thermocouple at Location A (10 o'clock position).
(a)Remove the bolt and nut from the clamp on the thermocouple wires and the brazed on bracket on the PT 4.95 manifold. Remove the lockwire and disconnect the PT 4.95 manifold from the pressure probe. Loosen the clamp bolts that attach the manifold to brackets on Flange T as necessary to get clearance for the thermocouple removal.
(b)Remove the lockwire and the two bolts that attach the thermocouple to the housing and exhaust case. Remove the thermocouple.
(3)Remove the thermocouple at Location B (7 o'clock position).
(a)Remove the bolt and nut that attach the PT 4.95 manifold to the bracket on Flange T.
(b)Remove the bolt, nut and spacer from the clamp on the thermocouple wires.
Remove the lockwire and the two bolts that attach the thermocouple and bracket to the housing and exhaust case. Move the bracket rearward and remove the thermocouple.
(4)Remove the thermocouple at Location C (4 o'clock position).
(a)Remove the bolt and nut from the clamps on the thermocouple wires and the PT 4.95 manifold. Remove the lockwire and disconnect the PT 4.95 manifold from the pressure probe.
(b)Remove the lockwire and the two bolts that attach the thermocouple and bracket to the housing and exhaust case. Move the bracket rearward and remove the thermocouple.
(5)Remove the thermocouple at Location D (1 o'clock position).
(a)Remove the lockwire and the bolts that attach the thermocouple and bracket to the housing and exhaust case. Move the bracket rearward and remove the thermocouple.
(6)Install protective closure

E. Installation (Post SB PW4 ENG 72-134) (Ref. Fig. 402)
(1)Remove the protection covers.
(2)Install thermocouple at Location A (10 o'clock position).
(a)Install the thermocouple into the housing and case, and align the bolt holes. Install bolts, threads lubricated with Material No.P06-023. TORQUE the bolts to between 54 and 60 lbf.in. (0.61 and 0.68 m.daN) and wirelock.
CAUTION : DO NOT USE LUBRICANTS ON FADEC SENSING TUBES, ADAPTERS, OR PACKINGS. CONTAMINATION OF FADEC CAN RESULT.
(b)Install the PT 4.95 manifold nut to probe adapter. TORQUE the manifold nut to between 135 and 150 lbf.in. (1.53 and 1.69 m.daN).
(c)TORQUE the clamp bolts that were loosened to between 36 and 40 lbf.in. (0.41 and 0.45 m.daN).
(d)Install the thermocouple wires to the bracket (brazed) on the PT 4.95 manifold with a clamp, bolt, threads lubricated with Material No.P03-001 and a nut. TORQUE the bolt to between 36 and 40 lbf.in. (0.41 and 0.45 m.daN).
(3)Install the thermocouple at Location B (7 o'clock position).

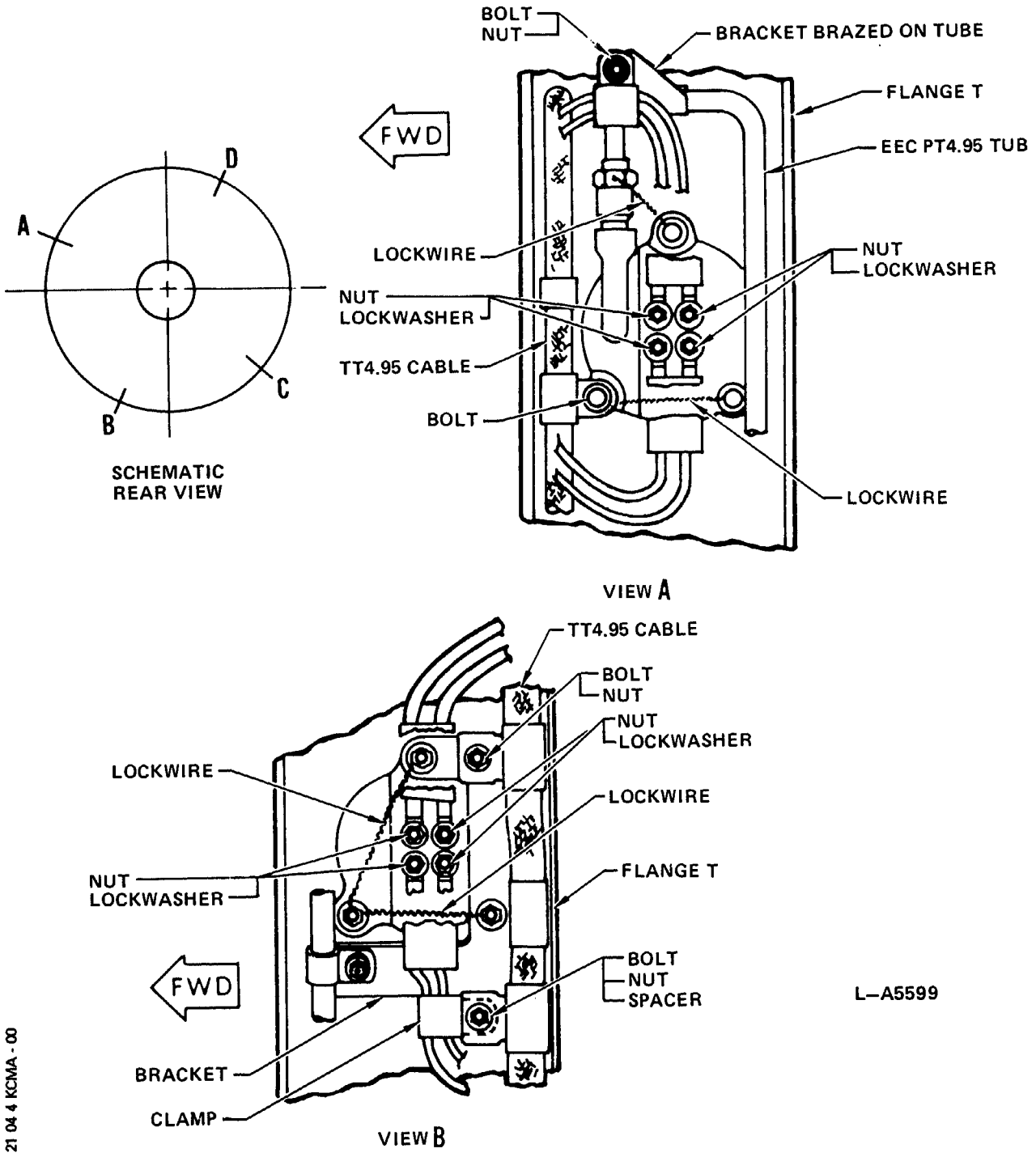
(a)Install the thermocouple into the housing and case, and align the bolt holes. Align the bracket and install two bolts, threads lubricated with Material No.P06-023. TORQUE the bolts to between 54 and 60 lbf.in. (0.61 and 0.68 m.daN) and wirelock.
(b)Attach the PT 4.95 manifold clamp to the bracket with a bolt, threads lubricated with Material No.P03-001, and nut. TORQUE the bolt to between 36 and 40 lbf.in. (0.41 and 0.45 m.daN).
(c)Install the thermocouple wires to the bracket with a clamp (next to bracket), spacer (between clamp and cable clamp), bolt, threads lubricated with Material No.P03-001, and nut. TORQUE the bolt to between 36 and 40 lbf.in. (0.41 and 0.45 m.daN).

(4)Install the thermocouple at Location C (4 o'clock position).
(a)Install the thermocouple into the housing and case, and align the bolt holes. Align the bracket and install bolts, threads lubricated with Material No.P06-023. TORQUE the bolts to between 54 and 60 lbf.in. (0.61 and 0.68 m.daN) and wirelock.
CAUTION : DO NOT USE LUBRICANTS ON FADEC SENSING TUBES, ADAPTERS, OR PACKINGS. CONTAMINATION OF FADEC CAN RESULT.
(b)Install the PT 4.95 manifold nut to the probe adapter. TORQUE the manifold nut to between 135 and 150 lbf.in. (1.53 and 1.69 m.daN) and wirelock.
(c)Install the thermocouple wires to the clamp on the PT 4.95 manifold with a clamp, bolt, threads lubricated with Material No.P03-001 and nut. TORQUE the bolt to between 36 and 40 lbf.in. (0.41 and 0.45 m.daN).

(5)Install the thermocouple at Location D (1 o'clock position).
(a)Install the thermocouple into the housing and case, and align the bolt holes. Align the bracket and attach with bolts, threads lubricated with Material No.P06-023. TORQUE the bolts to between 54 and 60 lbf.in. (0.61 and 0.68 m.daN) and wirelock.
CAUTION : TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(6)Attach the thermocouple wire connectors to the thermocouple studs. Install the washers and nut to the studs and torque the thermocouple nuts
(a)TORQUE the alumel connections (larger studs to between 10 and 15 lbf.in. (0.12 and 0.16 m.daN).
(b)TORQUE the chromel connections (smaller studs) to between 8 and 12 lbf.in. (0.10 and 0.13 m.daN).

F. Close-Up
(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(2)Remove access platform.
(3)Close thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301).
(4)Remove safety clips and tags and close circuit breakers : 35KS, 37KS, 34KS, 36KS.
(5)Test engine per Test Reference Table (Ref. 71-00-00, P. Block 501).



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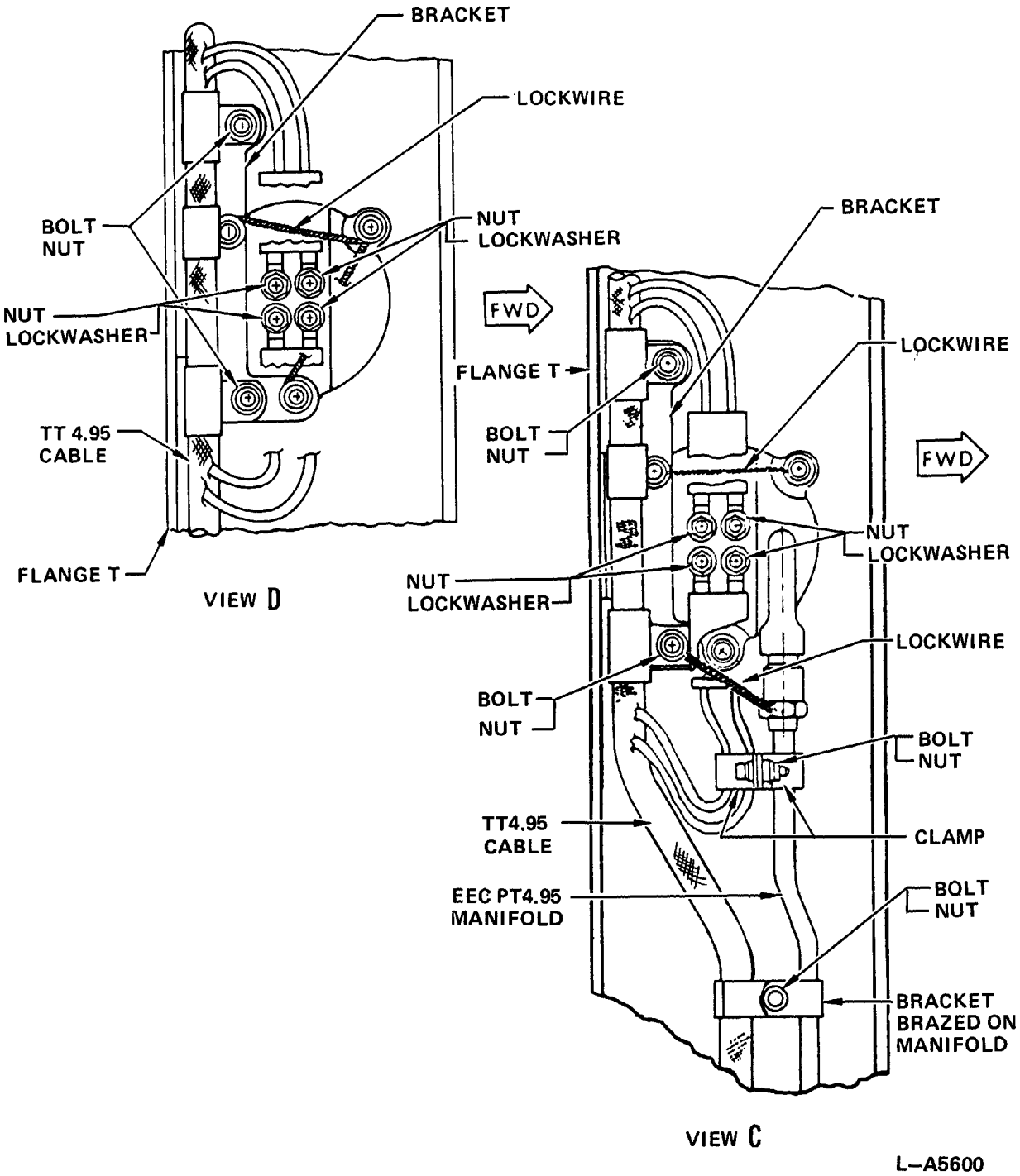
Exhaust Gas Temperature Thermocouple
(Post SB PW4 ENG 72-134) (Sheet 1/2)
Figure 402



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Exhaust Gas Temperature Thermocouple
(Post SB PW4 ENG 72-134) (Sheet 2/2)
Figure 402

EGT (TT4.95) THERMOCOUPLE - ADJUSTMENT/TEST

1. Equipment and Materials

ITEM	DESIGNATION
A.	Electronic Multimeter (Model 2795)
Referenced Procedure	
- 71-13-00, P. Block 301	Cowl Doors
- 77-21-04, P. Block 701	EGT (TT4.95) Thermocouple

2. Test EGT (TT4.95) Thermocouple for Continuity and Insulation Resistance

A. Procedure

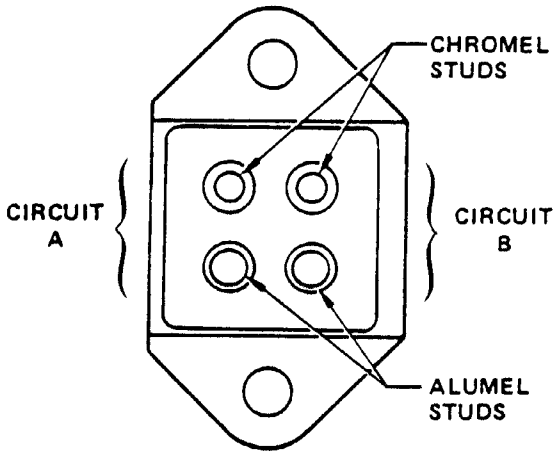
R (1)Job set-up
R (a)Install access platform.
R (b)Open, safety and tag the following circuit breakers :

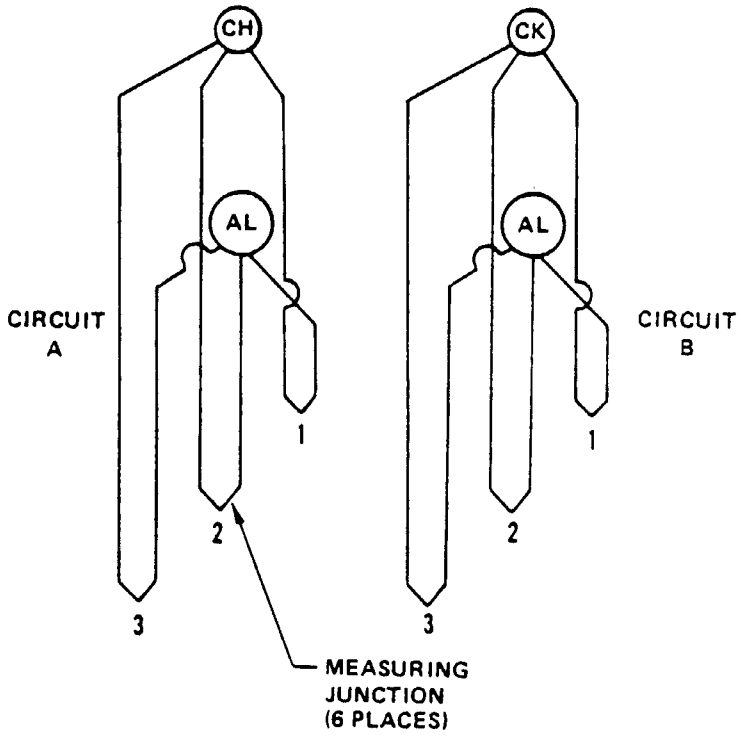
PANEL	SERVICE	IDENT.	LOCATION
FOR ENGINE 1			
133VU	ENG1/SCU SUPPLY FLT	37KS	333/T75
133VU	ENG1/SCU SUPPLY GND	35KS	333/T76
FOR ENGINE 2			
133VU	ENG2/SCU SUPPLY FLT	36KS	333/T84
133VU	ENG2/SCU SUPPLY GND	34KS	333/T85

R (c)Open fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).
(2)Procedure
(a)Clean EGT (TT4.95) thermocouple (Ref. 77-21-04, P. Block 701).
(b)Check for continuity and insulation resistance (Ref. Fig. 501).
NOTE : Before performing any of the following tests, be sure that thermocouple has been satisfactorily cleaned (Ref. 77-21-04, P. Block 701).
1 Apply heat at junctions of thermocouples with heat source.
2 Check for continuity by using low voltage ohmmeter at terminal posts. Deflection of needle on low voltage ohmmeter shows continuity in thermocouple circuits.
3 Using low voltage ohmmeter, check insulation resistance between both chromel and alumel terminals and body of thermocouple for minimum of 25 seconds for each measurement. Resistance must be at least 50,000 ohms. If resistance is within limits, thermocouples shall be returned to service.
NOTE : Low voltage ohmmeter utilizing less than 40 volts (DC) and maintained at an accuracy of five percent shall be used for determinating insulation resistance.
(c)Defective or rejected thermocouples fall into three basic categories.
1 No continuity in circuit.
2 Shorted circuit.
3 Low insulating resistance.

(d)Check for secondary junctions.
1 Apply heat gun to head of thermocouple to 600° - 700°F (316° - 371°C).
2 Check for deflection of milli-voltmeter at each set of studs. Milli-voltmeter should not deflect.

R (3)Close-up
R (a)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
R (b)Remove access platform.
R (c)Remove safety clips and tags and close circuit breakers : 35KS, 37KS, 34KS, 36KS.
R (d)Close thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301).





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Test Schematic
Figure 501

EGT (TT4.95) THERMOCOUPLE - INSPECTION/CHECK

1. Equipment and Materials

ITEM	DESIGNATION
Referenced Procedure - 77-21-04, P. Block 501	EGT (TT4.95) Thermocouple

2. Visually Inspect EGT (TT4.95) Thermocouple

A. Procedure

(1) Inspect exposed surfaces of thermocouple for cracks.

(2) Reject thermocouples with cracks.

NOTE : Minor nicks are not cause for rejection.

(3) Inspect terminals for looseness or thread damage.

(4) Check continuity and electrical installation resistance (Ref. 77-21-04, P. Block 501).

EGT (TT4.95) THERMOCOUPLE - CLEANING/PAINTING

1. Equipment and Materials

ITEM	DESIGNATION
A.	Stiff Bristle Brush Nonmetallic (Tampico)
Referenced Procedures	
- 70-00-00, P. Block 201	Engine - Standard Practices
- 77-21-04, P. Block 401	EGT (TT4.95) Thermocouple

2. Clean EGT (TT4.95) Thermocouple

A. Procedure

(1) Remove EGT (TT4.95) thermocouple (Ref. 77-21-04, P. block 401).

(2) Perform cleaning operations as necessary exercising caution to prevent mechanical damage.

WARNING : CLEANING SOLVENT IS FLAMMABLE. USE IN WELL VENTILATED AREA. AVOID CONTACT WITH SKIN.

CAUTION : INSULATION MATERIAL USED WITHIN THERMOCOUPLE PROBE WILL READILY ABSORB LIQUIDS. SINCE OPERATION OF THERMOCOUPLE MAY BE ADVERSELY AFFECTED BY PRESENCE OF LIQUIDS IN INSULATION, IT IS IMPORTANT THAT LIQUID SOLVENTS ARE NOT USED IN ANY WAY THAT WOULD PERMIT SOLVENT ENTRY INTO PROBE PAST TERMINAL STUDS.

(3) Clean thermocouple head (Ref. Fig. 701).

(a) Remove foreign deposits from head using brush and clean lint-free cloth moistened with a SPOP 208 solvent (Ref. 70-00-00, P. Block 201).

(b) Dry with clean dry compressed air.

NOTE : Compressed air shall be maintained at 30 psig (2.06 bars) maximum discharge pressure.

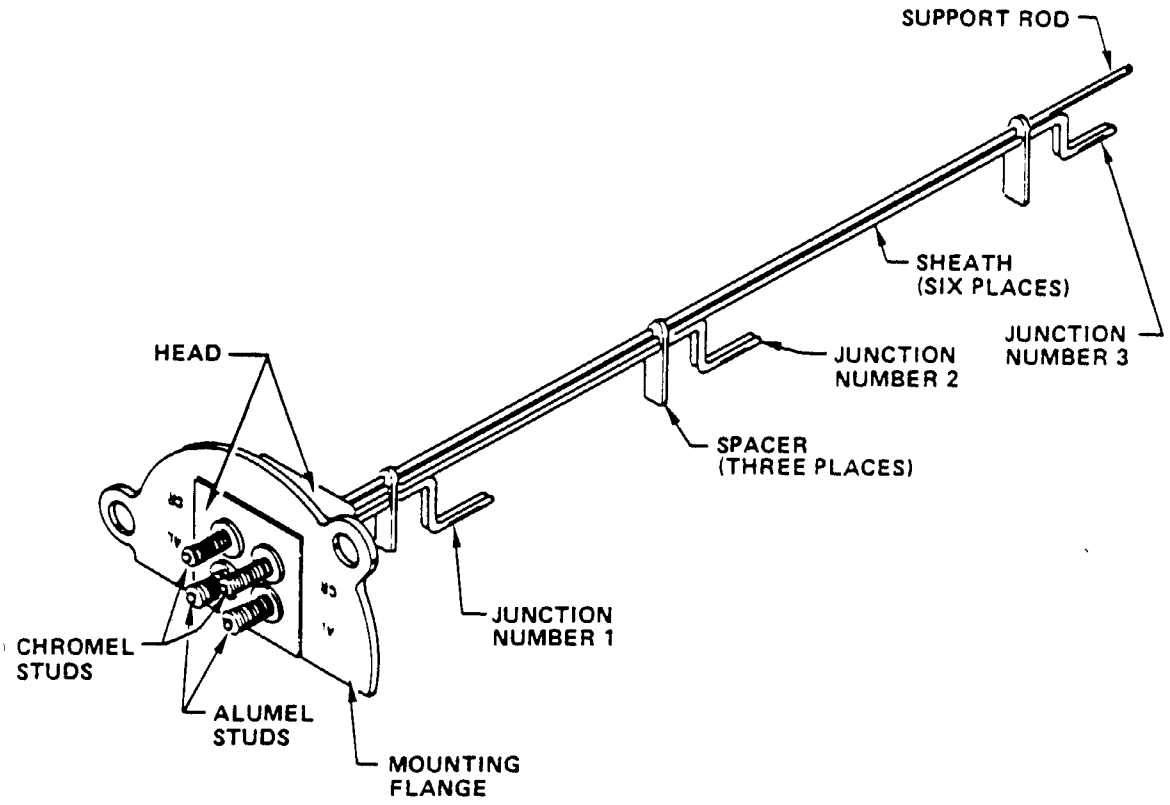
(4) Clean thermocouple sheath (Ref. Fig. 701).

(a) Remove loose carbon deposits from thermocouple sheath by directing air at approximately 100 psig (6.89 bars) through an air nozzle.

(b) To remove hardened carbon deposits from thermocouple sheath, use stiff bristle brush (nonmetallic) and a SPOP 208 solvent (Ref. 70-00-00, P. Block 201).

(c) Clean sheath by wiping surfaces with clean lint-free cloth moistened with a SPOP 208 solvent (Ref. 70-00-00, P. Block 201).

(d) Dry with clean dry compressed air.



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Thermocouple (TT4.95)
Figure 701

EGT (TT4.95) THERMOCOUPLE JUNCTION BOX - REMOVAL/INSTALLATION

1. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B. Material No.P03-001	Oils (Ref. 70-00-00)
C.	Corrosion Resistant Steel Lockwire (MS9226-03) (Ref. 70-00-00)
D.	Torque Wrench
Referenced Procedures	
- 71-00-00, P. Block 501	Power Plant - General
- 71-13-00, P. Block 301	Cowl Doors

2. Procedure

A. Job Set-Up

(1)Open, safety and tag the following circuit breakers :

PANEL	SERVICE	IDENT.	LOCATION
FOR ENGINE 1			
133VU	ENG1/SCU SUPPLY GND	35KS	333/T76
133VU	ENG1/SCU SUPPLY FLT	37KS	333/T75
FOR ENGINE 2			
133VU	ENG2/SCU SUPPLY GND	34KS	333/T85
133VU	ENG2/SCU SUPPLY FLT	36KS	333/T84

(2)Open fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

B. Removal (Ref. Fig. 401)

(1)Before disconnecting electrical leads, tag each lead and stud to facilitate proper reinstallation.

(2)Remove lockwire and four screws securing cover and ground lead to junction box. Remove cover.

(3)Remove two screws securing upper and lower clamp halves and thermocouple cable to junction box. Remove clamp halves.

(4)Remove nuts and disconnect W6 cable and thermocouple cable leads from junction box studs. Reinstall nuts on studs.

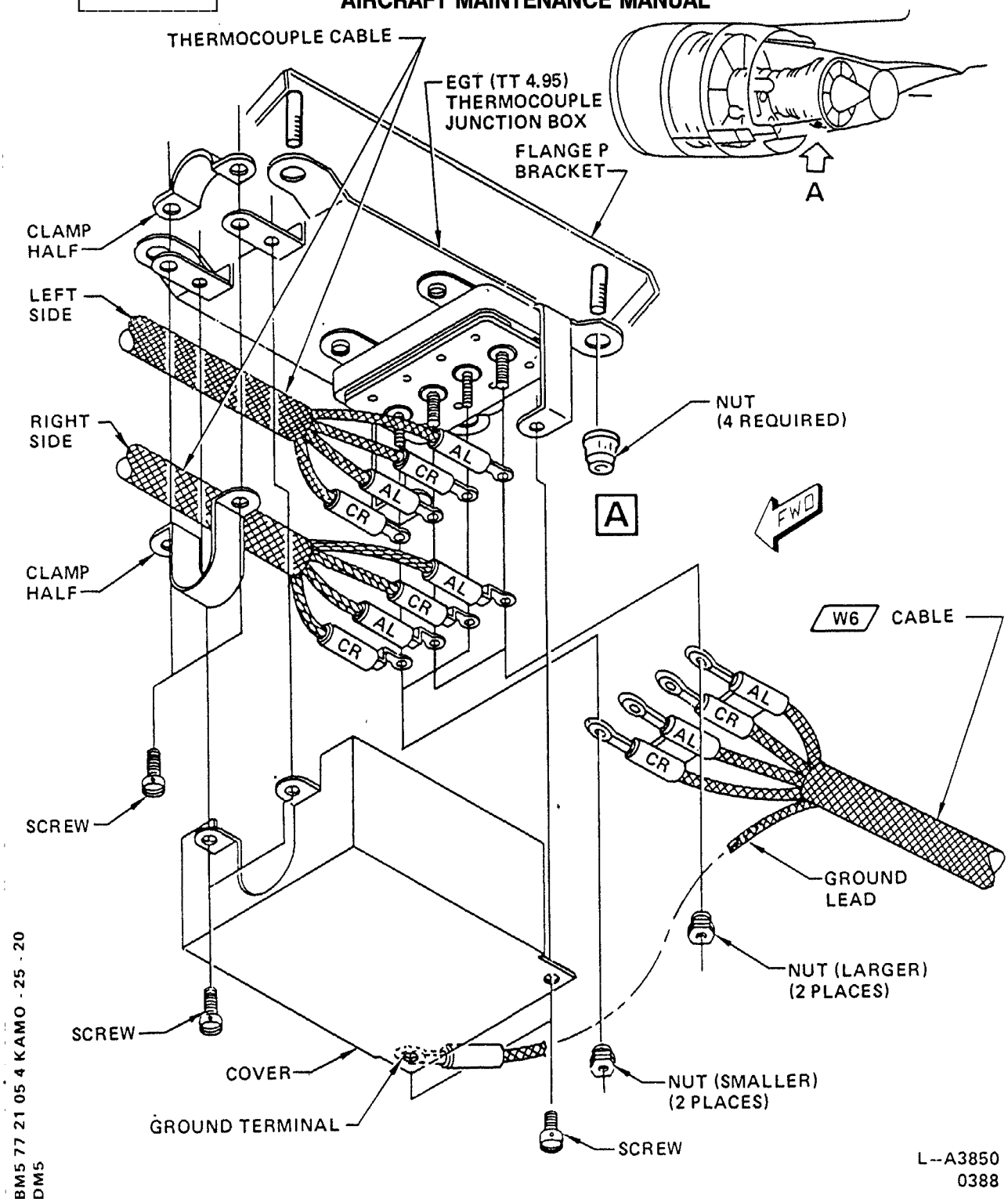
(5)Remove four nuts securing junction box to bracket on Flange P. Remove junction box from engine.

R NOTE : If terminal stud replacement is necessary, see paragraphs C and D.
R For additional information concerning detailed maintenance of box
R and cable assembly, see EGT (TT4.95) Thermocouple Box and Cable
R Component Maintenance Manual, 77-21-04 (Harco Laboratories).

R C. Removal of Damaged Stud(s) From Thermocouple Junction Box (Ref. Fig. 402)

R (1)Cut safety wire and remove from the four screws. Discard the safety wire.

R (2)Use a flat head screwdriver to remove the four screws which hold the
R mounting plate to the base plate.

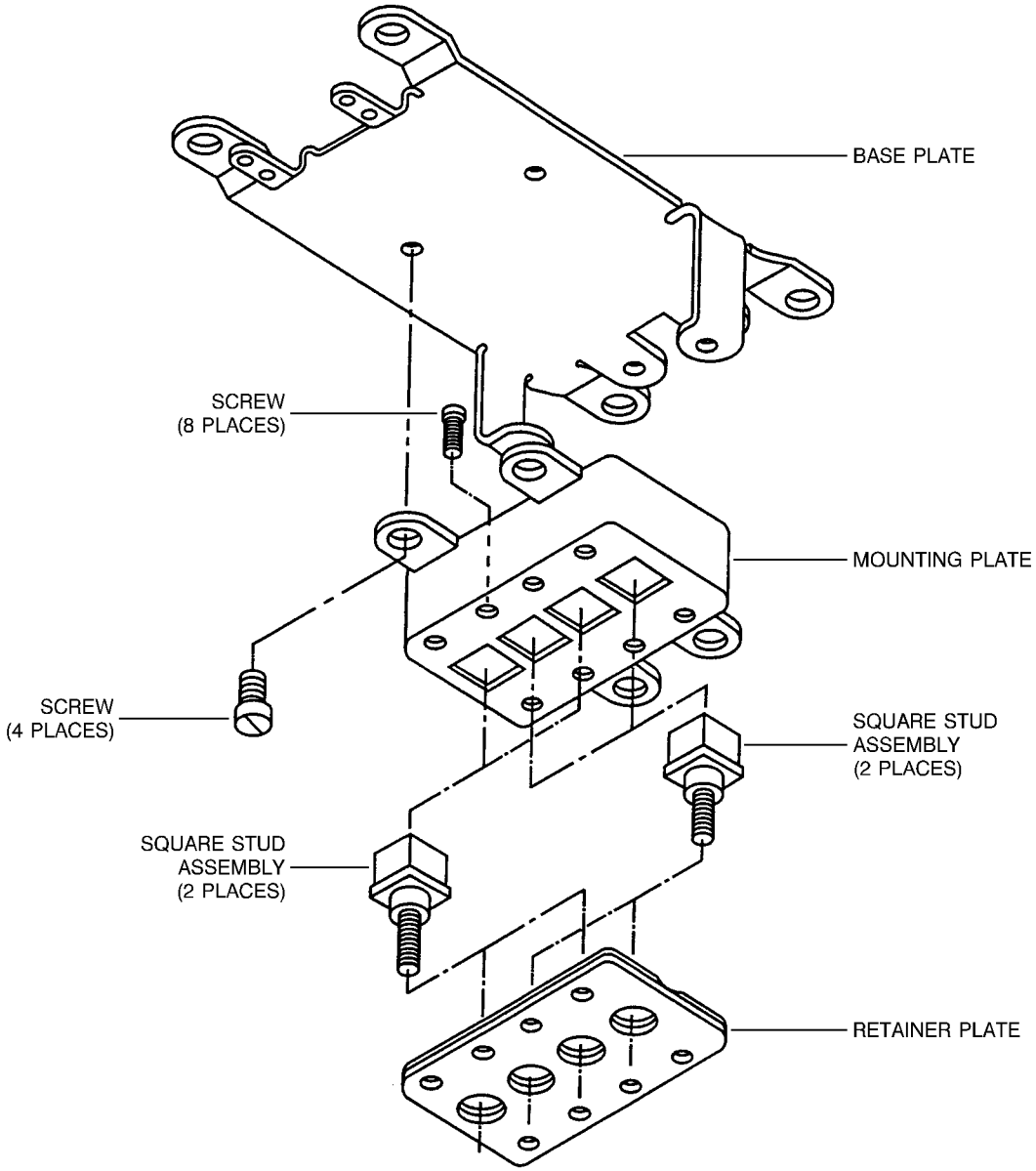


EGT (TT4.95) Thermocouple Junction Box
Figure 401

R (3)Cut safety wire and remove from the eight screws. Discard the safety wire.
R (4)Use a flat head screwdriver to remove the eight screws which hold the retainer plate to the mounting plate.
R (5)Remove the retainer plate from the mounting plate.
R NOTE : Hold the retainer up and the mounting plate down to prevent the stud from falling out.
R (6)Remove the damaged square stud(s) from the mounting plate.

R D. Installation of Replacement Stud(s) in the Thermocouple Junction Box (Ref. Fig. 402)
R (1)Install the new square stud(s) in the correct location(s) in the mounting plate.
R (2)Put the retainer plate on the square stud assemblies.
R (3)Install eight screws, threads lubricated with Engine Oil (Material No.P03-001), to the mounting plate to attach the retainer plate to the mounting plate.
R (4)Use a flat head screwdriver to tighten the eight screws that attach the retainer plate to the mounting plate. TORQUE screws to between 8.5 and 10 lbf.in. (0.097 and 0.112 m.daN) and lockwire.
R (5)Put the mounting plate to the base plate with four screws, threads lubricated with Engine Oil (Material No.P03-001).
R (6)Use a flat head screwdriver to tighten the four screws that attach the mounting plate to the base plate. TORQUE screws to between 16 and 20 lbf.in. (0.181 and 0.225 m.daN) and lockwire.

R E. Installation (Ref. Fig. 401)
(1)Install junction box on Flange P bracket. Lubricate threads of bracket studs with Material No.P03-001 and secure junction box to bracket with nuts. TORQUE nuts to between 32 and 36 lbf.in. (0.36 and 0.40 m.daN).
CAUTION : DO NOT ATTACH THE GROUND WIRE TO TERMINAL STUDS.
(2)Remove nuts from junction box studs. Connect and secure thermocouple cables and W6 cable leads to studs with nuts. Align leads so they are parallel to one another.
CAUTION : TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.
CAUTION : USE OF LUBRICATION IS NOT PERMITTED ON EITHER THE STUDS OR NUTS.
(3)(Pre SB PW4ENG 77-20) Torque junction box stud nuts as follows :
(a)TORQUE alumel connections (larger stud) to between 18 and 22 lbf.in. (0.20 and 0.25 m.daN).
(b)TORQUE chromel connections (smaller stud) to between 15 and 18 lbf.in. (0.17 and 0.20 m.daN).
CAUTION : TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.
CAUTION : USE OF LUBRICATION IS NOT PERMITTED ON EITHER THE STUDS OR LOCK NUTS.
CAUTION : ONCE A POST SB PW4ENG 77-20 NUT IS INSTALLED ONTO THE MATING STUD, YOU MUST NOT INSTALL A PRE SB PW4ENG 77-20 NUT ONTO THE



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L-D3031 (0705)
PW V

EGT (TT4.95) Thermocouple Junction Box Stud Replacement
Figure 402

R

STUD.

(4)(Post SB PW4ENG 77-20) Torque junction box stud nuts as follows :
(a)Connect averaging circuit leads to thermocouple junction box terminals.
(b)Run the nut onto the stud until finger tight so that the locking thread is in contact with the stud thread.
(c)Use a torque wrench with a resolution of 1 lbf.in. (0.011 m.daN) or smaller and run-on the nut to the stud as follows :
- minimum run-on torque for the smaller (0.164-32) thread diameter nut shall be 1.5 lbf.in. (0.016 m.daN)
- maximum run-on torque for the smaller (0.164-32) thread diameter nut shall be 9.0 lbf.in. (0.101 m.daN)
- minimum run-on torque for the larger (0.190-32) thread diameter nut shall be 2.0 lbf.in. (0.022 m.daN)
- maximum run-on torque for the larger (0.190-32) thread diameter nut shall be 13.0 lbf.in. (0.14 m.daN).

NOTE : You must perform a run-on test per step (d) to each nut as it is installed.

(d)Perform a run-on test as follows :
- use the torque wrench to install the nuts while you measure and record the torque necessary to run the nut down to the stud shoulder
- if any nut fails to meet the minimum or maximum torque requirement, use a new nut and repeat the test
- if a second nut fails to meet the minimum or maximum torque requirement, replace the stud per CMM 77-21-04.

(e)TORQUE the larger thread diameter nuts to between 25 and 30 lbf.in. (0.29 and 0.33 m.daN).
(f)TORQUE the smaller thread diameter nuts to between 20 and 25 lbf.in. (0.23 and 0.28 m.daN).
(5)Place clamp halves around cables and secure with two screws, threads lubricated with Material No.P03-001. TORQUE screws to between 16 and 22 lbf.in. (0.18 and 0.25 m.daN).
(6)Install cover on junction box. Install W6 cable ground lead terminal under front corner of cover. Secure cover and ground terminal with four screws. TORQUE screws to between 16 and 22 lbf.in. (0.18 and 0.25 m.daN) and wirelock.

NOTE : Do not wirelock clamp half screws together. Wirelock clamp half screws to cover screws.

R E. Close-Up and Test
(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(2)Close thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301).
(3)Remove safety clips and tags and close circuit breakers : 35KS, 37KS, 34KS, 36KS.
(4)Test engine per Test Reference Table (Ref. 71-00-00, P. Block 501).

EGT (TT4.95) THERMOCOUPLE HOUSING - REMOVAL/INSTALLATION

1. Equipment and Materials

ITEM	DESIGNATION
A.	Access Platform
B.	Circuit Breaker Safety Clips
C.	Corrosion Resistant Steel Lockwire (AS3214-02) (Ref. 70-00-00)
D.	Torque Wrench
E.	Protective Closures
F. Material No.P03-001	Oils (Ref. 70-00-00)
G. Material No.P06-023	Lubricants (Ref. 70-00-00)
Referenced Procedures	
- 71-00-00, P. Block 501	Power Plant - General
- 71-13-00, P. Block 301	Cowl Doors

2. Procedure

A. Job Set-Up

(1)Open, safety and tag the following circuit breakers :

PANEL	SERVICE	IDENT.	LOCATION
FOR ENGINE 1			
133VU	ENG1/SCU SUPPLY GND	35KS	333/T76
133VU	ENG1/SCU SUPPLY FLT	37KS	333/T75
FOR ENGINE 2			
133VU	ENG2/SCU SUPPLY GND	34KS	333/T85
133VU	ENG2/SCU SUPPLY FLT	36KS	333/T84

(2)Install access platform.

(3)Open fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

B. Removal (Ref. Fig. 401)

(1)Remove nuts and washers securing cable ends to thermocouple connections. Remove cable ends from thermocouple.

(2)Remove lockwire and two bolts securing thermocouple to boss on case. At location B only, remove bolt and nut securing PT4.95 manifold to bracket.

(3)(Post SB PW4 ENG 72-134) At location B remove the bolt, nut and spacer from the clamp on the thermocouple wires.

(4)Remove remaining bolt securing EGT (TT4.95) thermocouple housing to exhaust case boss.

(5)Move bracket to rear and remove EGT thermocouple probe. Remove housing from case.

(6)Install protective closures.

C. Installation (Ref. Fig. 401)

(1)Remove protective closures.

(2)Install EGT (TT4.95) thermocouple housing to exhaust case bosses

aligning boltholes. Install one bolt (in forward hole), threads lubricated with Material No.P06-023, handtight only.

(3)Install EGT (TT4.95) thermocouple probe into housing aligning rearward boltholes. Position harness bracket over probe holes and install two bolts, threads lubricated with Material No.P06-023, handtight only.

(4)TORQUE all bolts to between 54 and 60 lbf.in. (0.61 and 0.68 m.daN) and wirelock.

(5)At location B only, secure PT4.95 manifold clamp with bolt, threads lubricated with Material No.P03-001, and nut. TORQUE bolt to between 36 and 40 lbf.in. (0.41 and 0.45 m.daN).

CAUTION : TOO MUCH TORQUE (MORE THAN MAXIMUM TORQUE) ON THE THERMOCOUPLE NUTS CAN LOOSEN OR DAMAGE THE THERMOCOUPLE STUDS.

(6)Connect thermocouple cable leads to thermocouple probe and secure with washers and nuts. TORQUE nust as follows :

(a)TORQUE alumel connections (larger studs) to between 10 and 15 lbf.in (0.11 and 0.17 m.daN).

(b)TORQUE chromel connections (smaller studs) to between 8 and 12 lbf.in. (0.10 and 0.13 m.daN).

(7)(Post SB PW4 ENG 72-134) at location B install the thermocouple wires to the bracket with a clamp (next to bracket), spacer (between clamp and cable clamp), bolt, threads lubricated with Material No.P03-001 and nut.
TORQUE the bolt to between 36 and 40 lbf.in. (0.41 and 0.45 m.daN).

D. Close-Up

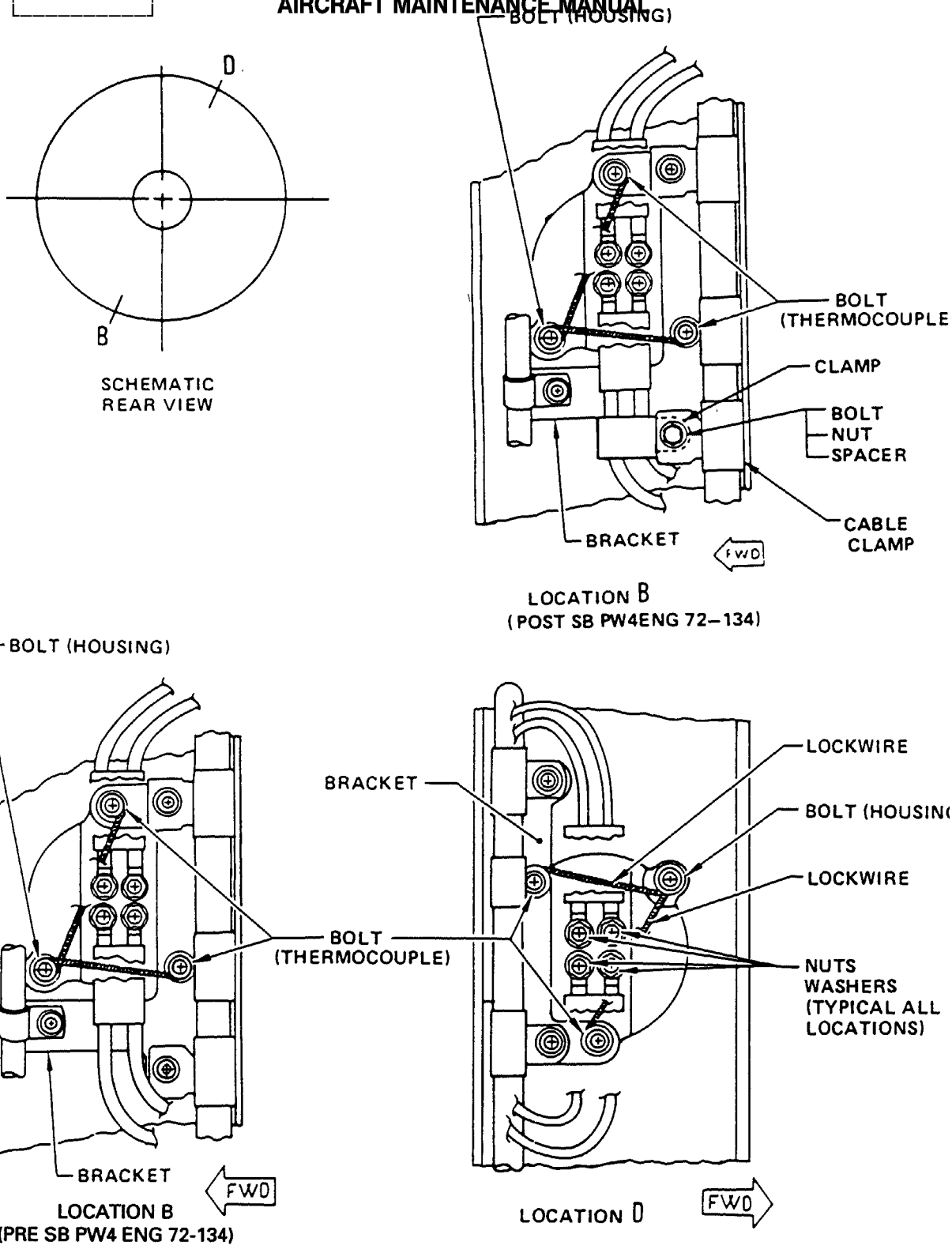
(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.

(2)Remove access platform.

(3)Close thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301).

(4)Remove safety clips and tags and close circuit breakers : 35KS, 37KS, 34KS, 36KS.

(5)Test engine per Test Reference Table (Ref. 71-00-00, P. Block 501).



EGT (TT4.95) Thermocouple Housing
Figure 401

EGT (TT4.95) THERMOCOUPLE HOUSING - INSPECTION/CHECK

1. Equipment and Materials

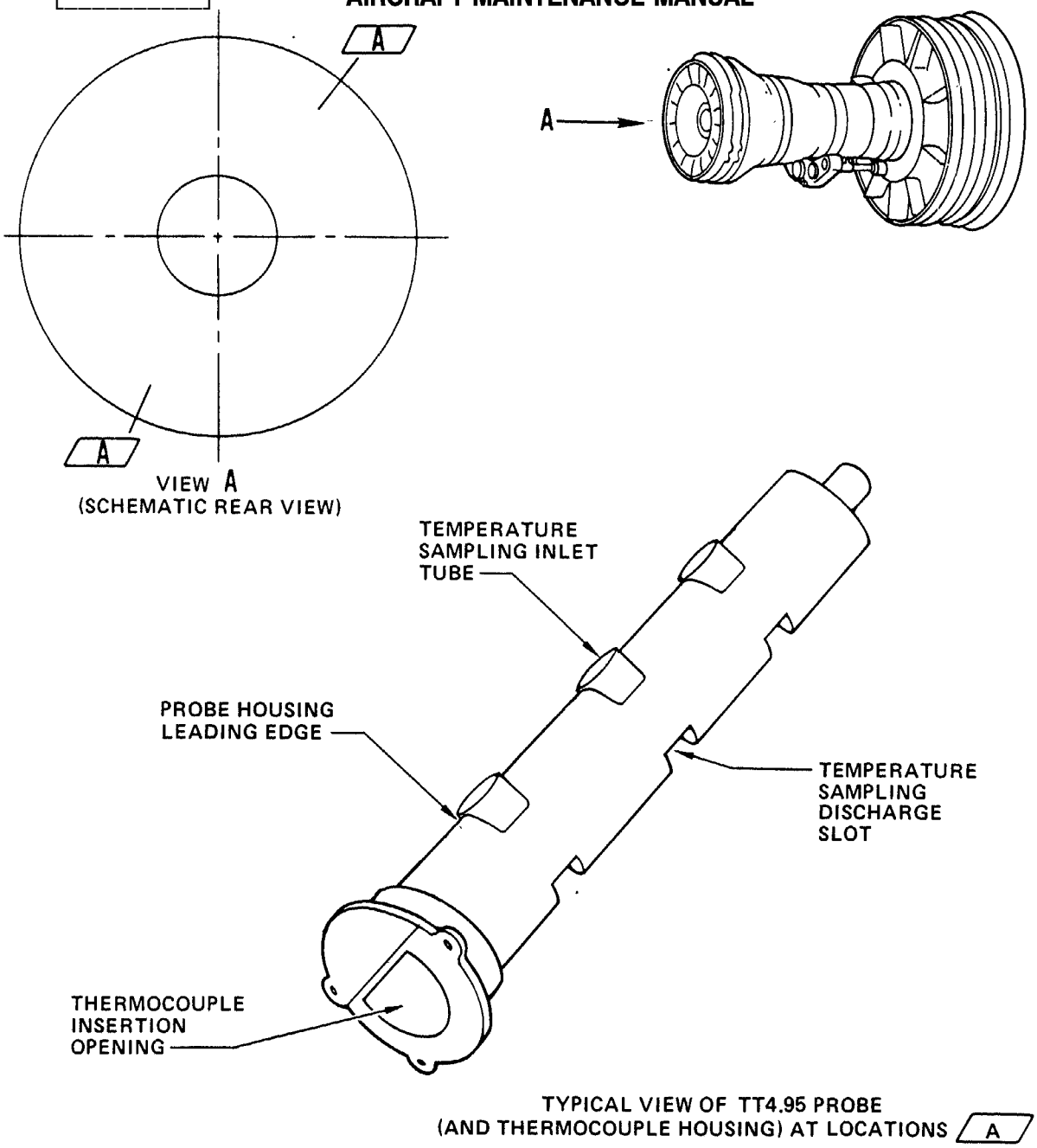
ITEM	DESIGNATION
Referenced Procedure - 77-21-06, P. Block 401	EGT (TT4.95) Thermocouple Housing

2. Procedure

A. Job Set-Up
(1) Remove EGT (TT4.95) thermocouple housing (Ref. 77-21-06, P. Block 401).

B. Visual Inspection (Ref. Fig. 601, 602)
(1) Inspect probe housing for nicks, dents, cracks and deformation.
(a) Nicks and dents are acceptable.
(b) Deformation due to heat is acceptable provided assembly into engine or thermocouple installation is not affected.
(c) Cracked probe housings should be rejected.
(2) Inspect three temperature sampling tubes and six slots on leading edge or probe casting for obstructions to flow path. Line of sight flow path to probe slots on leading edge of housing should be maintained.
(3) Three temperature sampling discharge slots on probe housing, trailing edge should be open to minimum width and length indexes 2 and 1 (Ref. Fig. 602) as viewed from the rear.
(4) The temperature sensing slots on probe leading edge and surrounded by inlet tubes must be open to minimum width and length indexes 3 and 5 (Ref. Fig. 602) as viewed from the front.

C. Close-Up
(1) Install EGT (TT4.95) thermocouple housing (Ref. 77-21-06, P. Block 401).
(2) Make certain that working area is clean and clear of tools and miscellaneous items of equipment.



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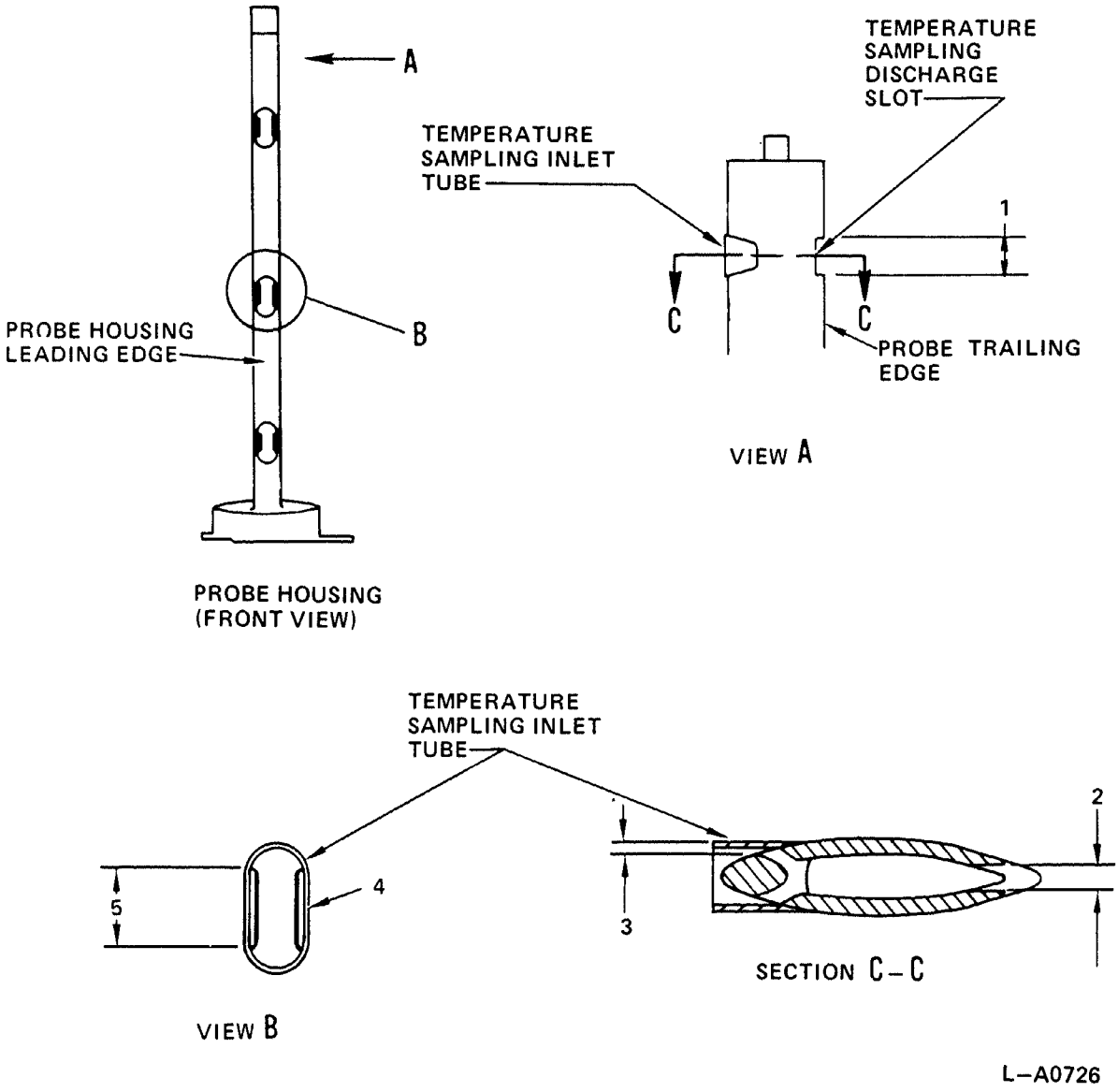
EGT (TT4.95) Thermocouple Housing
Figure 601



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EGT (TT4.95) Thermocouple Housing
Figure 602

EGT INDICATOR - REMOVAL/INSTALLATION

NOTE : Removal/Installation procedures for EGT indicators of L and R engines are identical.

1. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Blanking Caps/Plugs
Referenced Procedure - 24-41-00, P. Block 301	AC External Power Control

2. Procedure

A. Job Set-Up

(1)Open, safety and tag the following circuit breakers :

PANEL	SERVICE	IDENT.	LOCATION
133VU	ENGINES/ENG1 EGT	1EY	333/T73
133VU	ENGINES/ENG2 EGT	2EY	333/T74
133VU	ENGINES/ENG1 & 2 IND MAX POINTER RESET	1ER	332/U71

B. Removal

**ON A/C 101-200,

Post SB 72-2032 For A/C 101-200,

(Ref. Fig. 401)

**ON A/C 101-200,

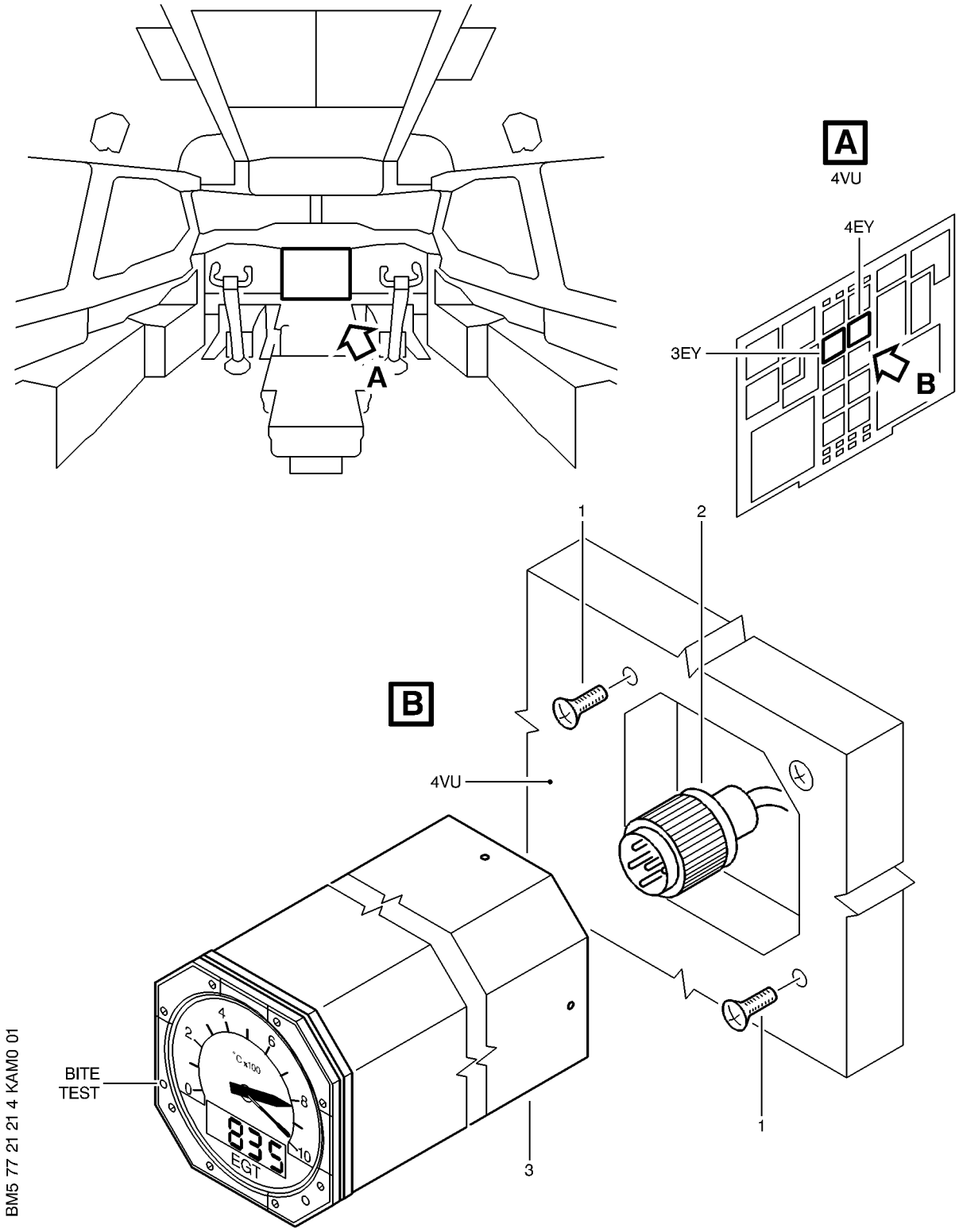
(Ref. Fig. 402)

(1)On face of panel 4VU, remove two screws (1) attaching EGT indicator.
(2)Remove EGT indicator (3) from panel 4VU.
(3)Disconnect EGT indicator and blank off plug and receptacle (2).

C. Installation

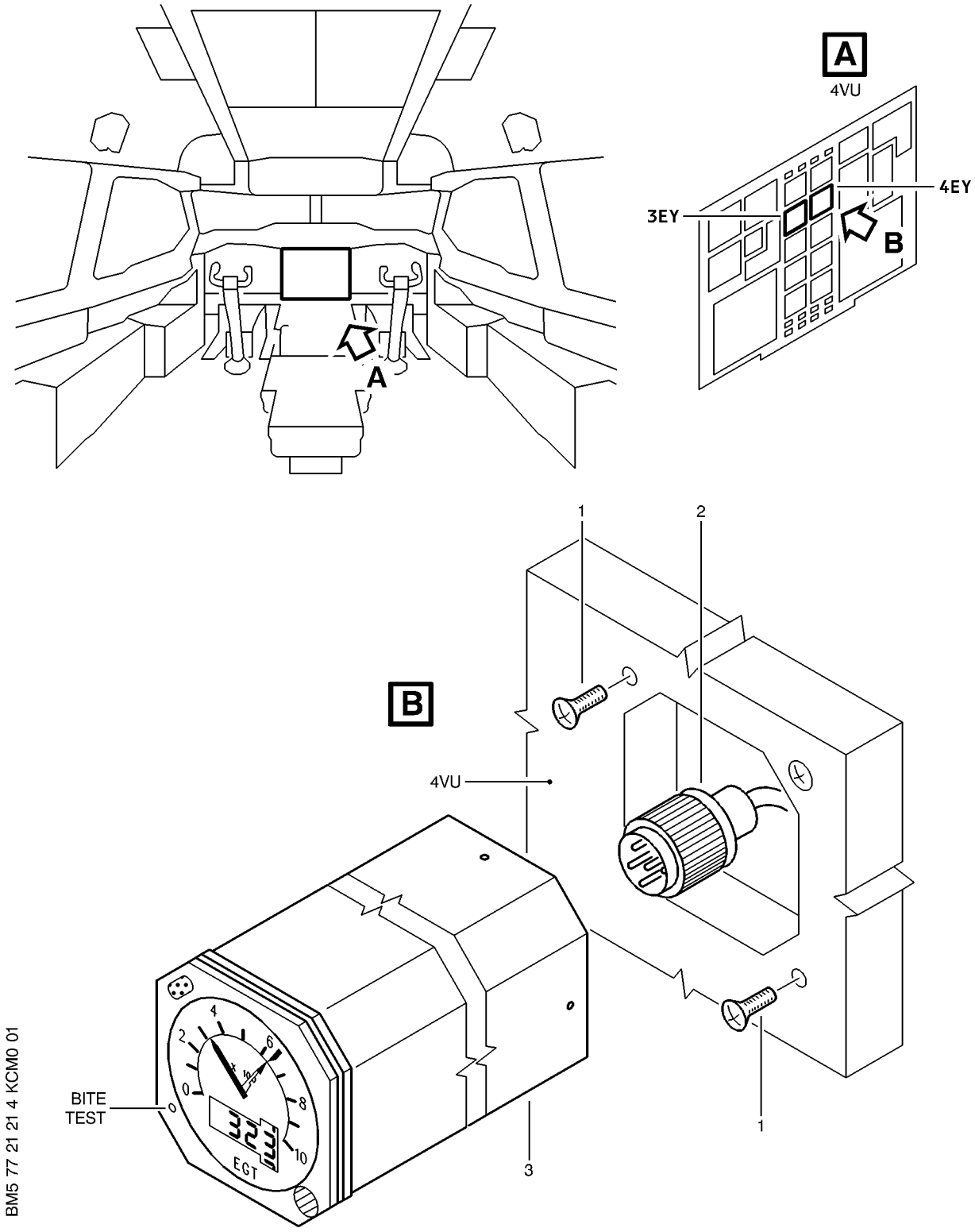
(1)Check housing of EGT indicator on panel 4VU.
(2)Remove blanking caps from plug and receptacle (2) and connect plug.
(3)Install EGT indicator (3) in panel 4VU.
(4)Attach EGT indicator (3) to panel 4VU with two screws (1).
(5)Remove safety clips and tags and close circuit breakers 1EY, 2EY and 1ER.

**ON A/C 101-200,



EGT Indicator
Figure 401

R



EGT Indicator
Figure 402

R

D. Test
(1)Connect electrical ground power unit (Ref. 24-41-00, P. Block 301).
(2)Make certain that electrical supply is correct (28VDC, 115VAC, 26VAC).

ACTION	RESULT
(1)On panel 4VU - maintain slot of BITE screw or Press-To-Test button, located in LH lower section of EGT indicator 3EY (4EY) in S position or pressed in, respectively. - release BITE screw from S position or release Press-To-Test button.	On EGT indicator 3EY (4EY) - the main pointer indicates 975° ± 10°C (the main pointer aligns with the blue mark). - the digital counter indicates 975°C ± 1°C. - amber overtemperature warning light comes on. - the main pointer returns to 0°C position. - the maximum indicating pointer remains in front of the blue mark. - amber overtemperature warning light goes off.

**ON A/C 101-200,

D. Test
(1)Connect electrical ground power unit (Ref. 24-41-00, P. Block 301).
(2)Make certain that electrical supply is correct (28VDC, 115VAC, 26VAC).

ACTION	RESULT
(1)On panel 4VU - maintain slot of BITE screw or Press-To-Test button, located in LH lower section of EGT indicator 3EY (4EY) in S position or pressed in, respectively. - release BITE screw from S position or release Press-To-Test button.	On EGT indicator 3EY (4EY) - the main pointer indicates 975° (the main pointer aligns with the blue mark). - the digital counter indicates 975°C. - amber overtemperature warning light comes on. - the main pointer returns to 0°C position. - the maximum indicating pointer remains in front of the blue mark. - amber overtemperature warning light goes off.
(2)On panel 472VU - press ENG/IND MAX/POINTER/RESET pushbutton switch	On panel 4VU, EGT indicator 3EY (4EY) - the maximum indicating pointer returns in front of the red mark.

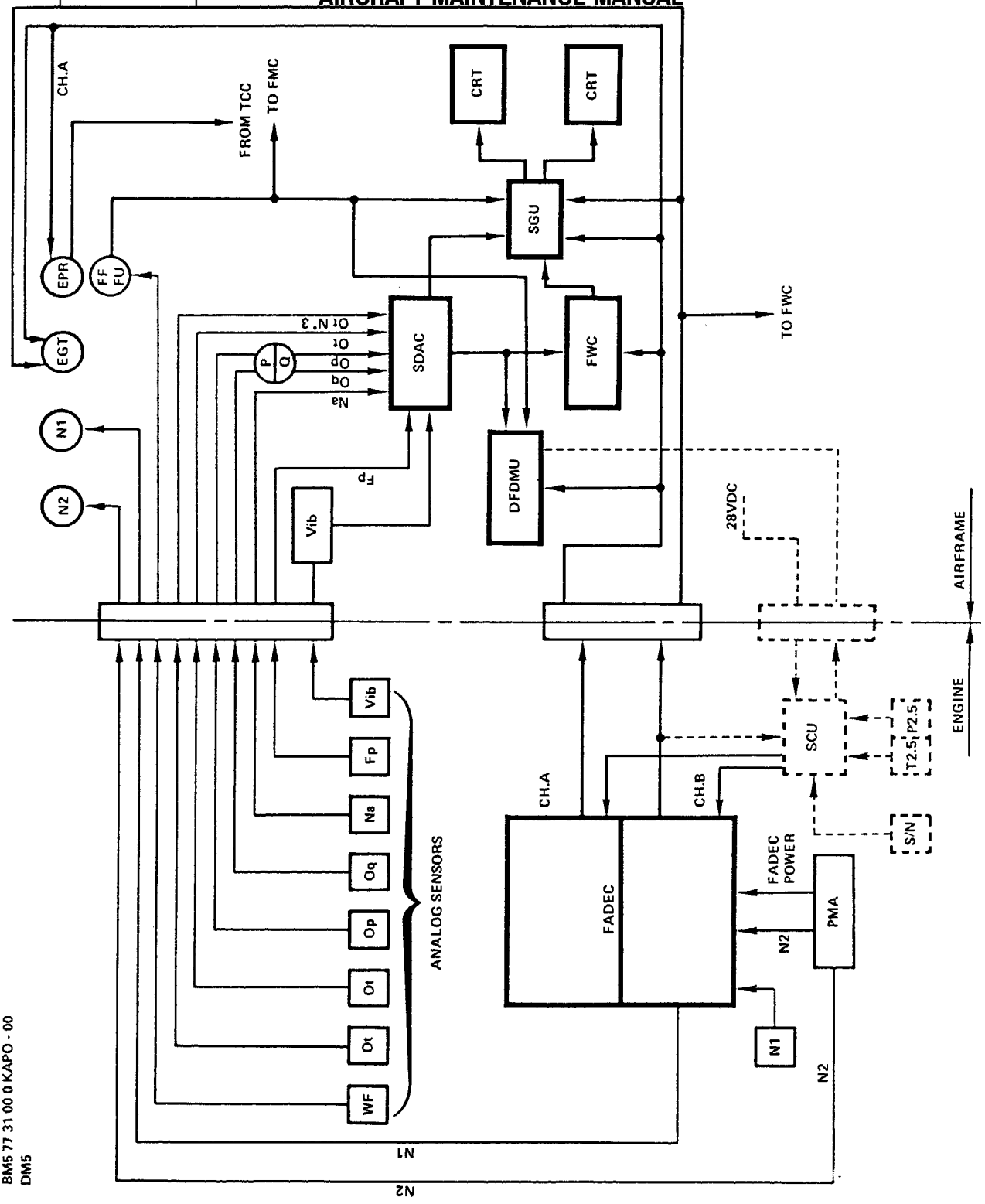
E. Close-up
(1)De-energize the aircraft electrical network and disconnect electrical ground power unit (Ref. 24-41-00, P. Block 301).
(2)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(3)Restore aircraft systems to normal operating condition.

ENGINE AIDS (MINI-MUX) - DESCRIPTION AND OPERATION

1. General (Ref. Fig. 001, 002)
   In addition to the engine parameters available at the output of the FADEC (channel A and B), some extra engine parameters are calculated in the Supplementary Control Unit (SCU) which is a part of the optional Airborne Integrated Data System (AIDS) and interfaces with the FADEC. (channel B)
   The SCU is vibration isolated, mounted on engine fan case (approximately at 1 o'clock) and cooled by the natural convection ; it receives data from the engine in analog form and from the FADEC in digital format. These signals are transmitted (in digital format) to the AIDS system.

2. Description
   The kit consists of the SCU, an engine serial number data entry plug, wiring harness modification and an optional engine station 2.5 N1 probe. The probe is used to sense T2.5 and P2.5. Both of these signals are supplied to the SCU. The T2.5 is a 'K' type thermocouple and the P2.5 is a pneumatic signal plumbed to the SCU pressure transducer. The data entry plug is a part which is attached to the engine via a lanyard. The plug encodes the engine serial number for sensing by the SCU.
   The SCU is powered by the 28 VDC bus. The processor handles all the input and output interfaces. The inputs include :
   - The chromel/alumel T2.5 signal via a cold reference junction and A/D converter.
   - The pneumatic P2.5 signal via a vibrating cylinder pressure transducer and F/D converter.
   - The discrete encoded engine serial number via the data entry plug and a discrete input interface.
   - The ARINC 429 output from the FADEC 'B' channel via an ARINC 429 input interface.

   The output is an ARINC 429 interface which contains all the data received from the FADEC plus the data sensed by the SCU.



Airborne Integrated Data System (AIDS)
Figure 001

3. Operation

A. Digital Output Characteristics
The digital output data is sent by the SCU on an ARINC 429 bus.
Information contained on the SCU output data bus includes the following items :
- FADEC output bus parameters
- Engine serial number
- Station 2.5 pressure and temperature
- SCU maintenance data word.

The list of SCU specific output is shown on tables 0001 and 0002.

B. Electrical Power Interface with SCU
The SCU operates off of the 28VDC electrical system. The power is supplied to the SCU from the main 28VDC bus through a circuit breaker.
The SCU interfaces (28VDC power and ARINC 429 output) are both protected from 115VAC shorts via fuses internal to the SCU.

BIT	FUNCTION	BIT STATUS 0	1
1	Octal Label	X	
2	Octal Label		X
3	Octal Label		X
4	Octal Label	X	
5	Octal Label		X
6	Octal Label		X
7	Octal Label	X	
8	Octal Label		X
9	SDI	X	
10	SDI	X	
11	PAD	X	
12	PAD	X	
13	PAD	X	
14	ARINC Output Bus W/A Failed	OK	Fault
15	Appl. Program Checksum Failed	OK	Fault
16	RAM Test Failed	OK	Fault
17	CPU Instruction Test Failed	OK	Fault
18	FADEC Powered by SCU	OK	Fault
19	Spare		
20	Watchdog Timer Test Failed	OK	Fault
21	P2.5 Range Fail	OK	Fault
22	Spare		
23	Spare		
24	Spare		
25	FADEC Channel A ARINC Input Failed	OK	Fault
26	S/N Plug Missing or Invalid	OK	Fault
27	FADEC Channel B ARINC Input Failed	OK	Fault
28	T2.5 Range Fail	OK	Fault
29	SCU Unit Fault	OK	Fault
30	SSM	SEE NOTE	SEE NOTE
31	SSM	SEE NOTE	SEE NOTE

BIT	FUNCTION	BIT STATUS 0	1
32	PARITY (ODD)		

NOTE : Normal operating code is set if sensor is annunciated not failed - (11).
Failure warning code is set if sensor is annunciated as failed - (00).

SCU Maintenance Word # 1 Octal Label 155
Table 0001

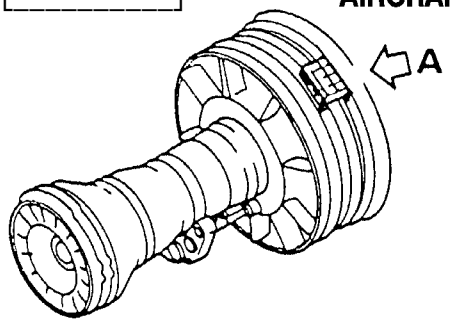
BIT	FUNCTION	BIT STATUS 0	1
1	Octal Label		X
2	Octal Label	X	
3	Octal Label		X
4	Octal Label		X
5	Octal Label		X
6	Octal Label		X
7	Octal Label		X
8	Octal Label	X	
9	SDI	X	
10	SDI	X	
11	PAD	X	
12	PAD	X	
13	PAD	X	
14	Spare	X	
15	Spare	X	
16	Lock-out Monitor Failed	OK	Failed
17	Spare	X	
18	Spare	X	
19	Spare	X	
20	FADEC ARINC Data CH.A	Not CH.A	CH.A
21	FADEC ARINC Data CH.B	Not CH.B	CH.B
22	Spare	X	
23	Spare	X	
24	FADEC Power Source	FROM PWA	FROM SCU
25	Spare	X	
26	Spare	X	
27	Spare	X	
28	Spare	X	
29	Spare	X	
30	SSM	SEE NOTE	SEE NOTE
31	SSM	SEE NOTE	SEE NOTE
32	PARITY (ODD)		

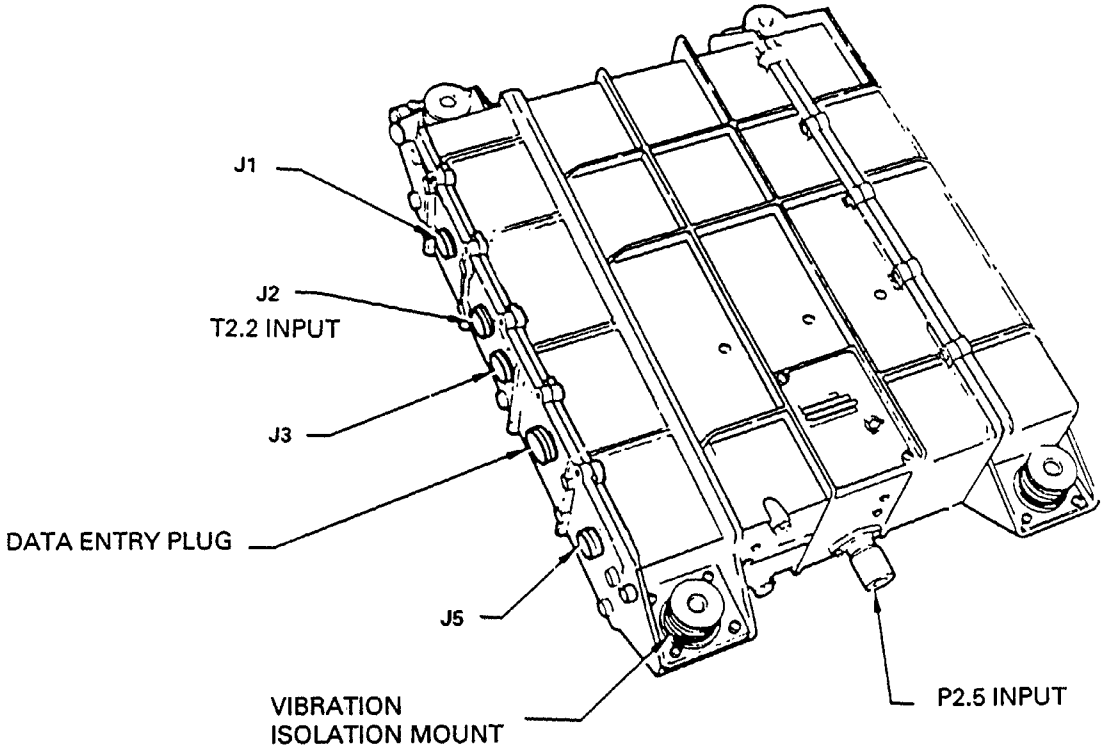
NOTE : Normal operating code is set if sensor is annunciated not failed - (11).
Failure warning code is set if sensor is annunciated as failed - (00).

SCU Status Word # 1 Octal Label 145

BIT	FUNCTION	BIT STATUS 0	1

Table 0002





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Supplementary Control Unit
Figure 002

PROPULSION MULTIPLEXER UNIT (PMUX) - INSPECTION/CHECK

1. Equipment and Materials

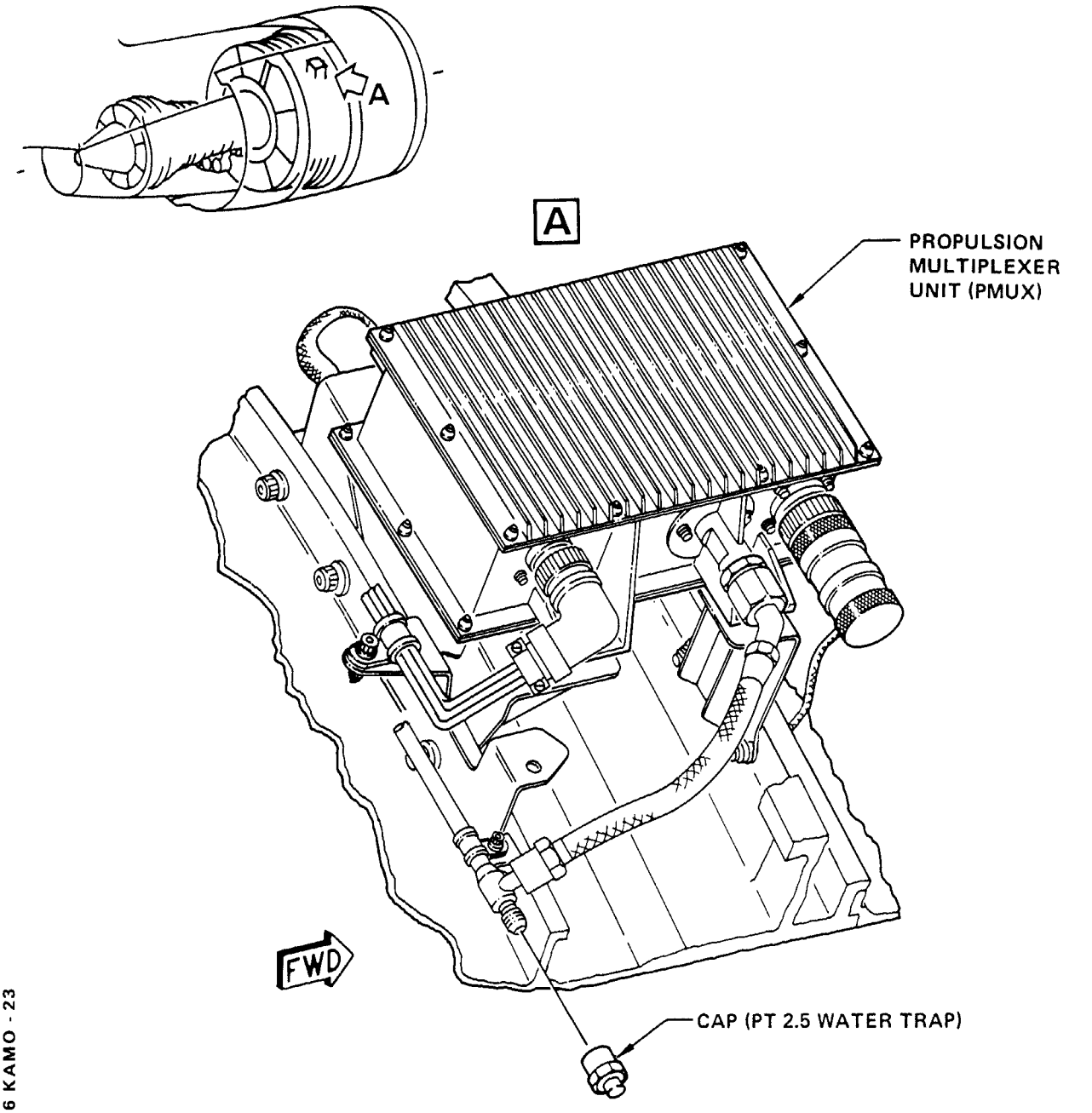
ITEM	DESIGNATION
A.	Circuit Breakers Safety Clips
B.	Corrosion Resistant Steel Lockwire (AS3214-02) (Ref. 70-00-00)
C.	Torque Wrench
Referenced Procedure - 71-13-00, P. Block 301	Cowl Doors

2. Procedure

A. Job Set-Up
(1)Open, safety and tag the appropriate circuit breakers and open fan cowl doors (Ref. 71-13-00, P. Block 301).

B. Inspect PT2-5 Water Trap (Ref. Fig. 601)
(1)Remove lockwire and trap from manifold tee. Allow water to drain.
CAUTION : USE OF LUBRICANTS ON FADEC SENSING TUBES, ADAPTERS, OR PACKINGS COULD RESULT IN CONTAMINATION OF FADEC.
(2)Install trap to manifold tee. TORQUE trap to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN) and secure with lockwire.

C. Close-Up
(1)Close fan cowl doors (Ref. 71-13-00, P. Block 301). Remove safety clips and tags and close circuit breakers.



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PT2.5 Water Trap
Figure 601

ENGINE VIBRATION INDICATING - DESCRIPTION AND OPERATION

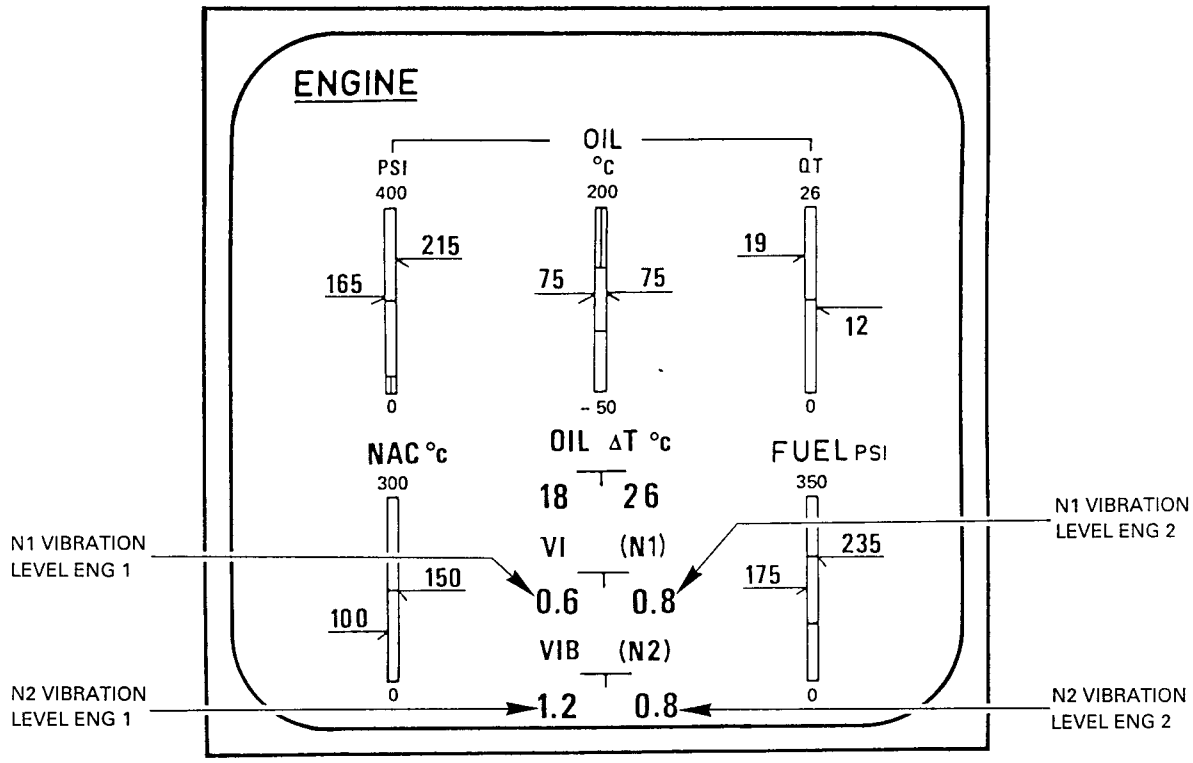
1. Description (Ref. Fig. 001, 002)

The engine vibration monitoring is recommended as a diagnostic indication, to give a tendency and provide for maintenance actions on the engine.
Vibration monitoring is provided by an accelerometer on the fan case (Flange A). This transducer senses any vibration induced by low speed or high speed rotor assemblies and transmits it, via a coaxial cable, to an amplifier.
This amplifier receives also both N1 and N2 speed signals from the relevant transducers. These signals are processed by the amplifier to determine the central frequencies of two tracking filters. The filters define the narrow frequency band to be analyzed by the amplifier, in order to correlate the vibration level with the rotor speed (first harmonic).
The amplifier outputs (2 per engine), are 0 to 5VDC signals. These signals are received by the SDAC which multiplexes them on the ARINC 429 data busbar linked with the ECAM SGU and Display Units.

2. Compoment Location

(Ref. Fig. 003)

FIN	FUNCTIONAL DESIGNATION	PANEL	ZONE	ACCESS DOOR	ATA REF.
T588	ACCELEROMETER		436	436AR	77-32-02
			446	446AR	77-32-02
3EV	CONDITIONER UNIT - SIGNAL	95VU	122	121BL	77-32-00
2EV	VIB TEST SWITCH	472VU	212		77-32-00



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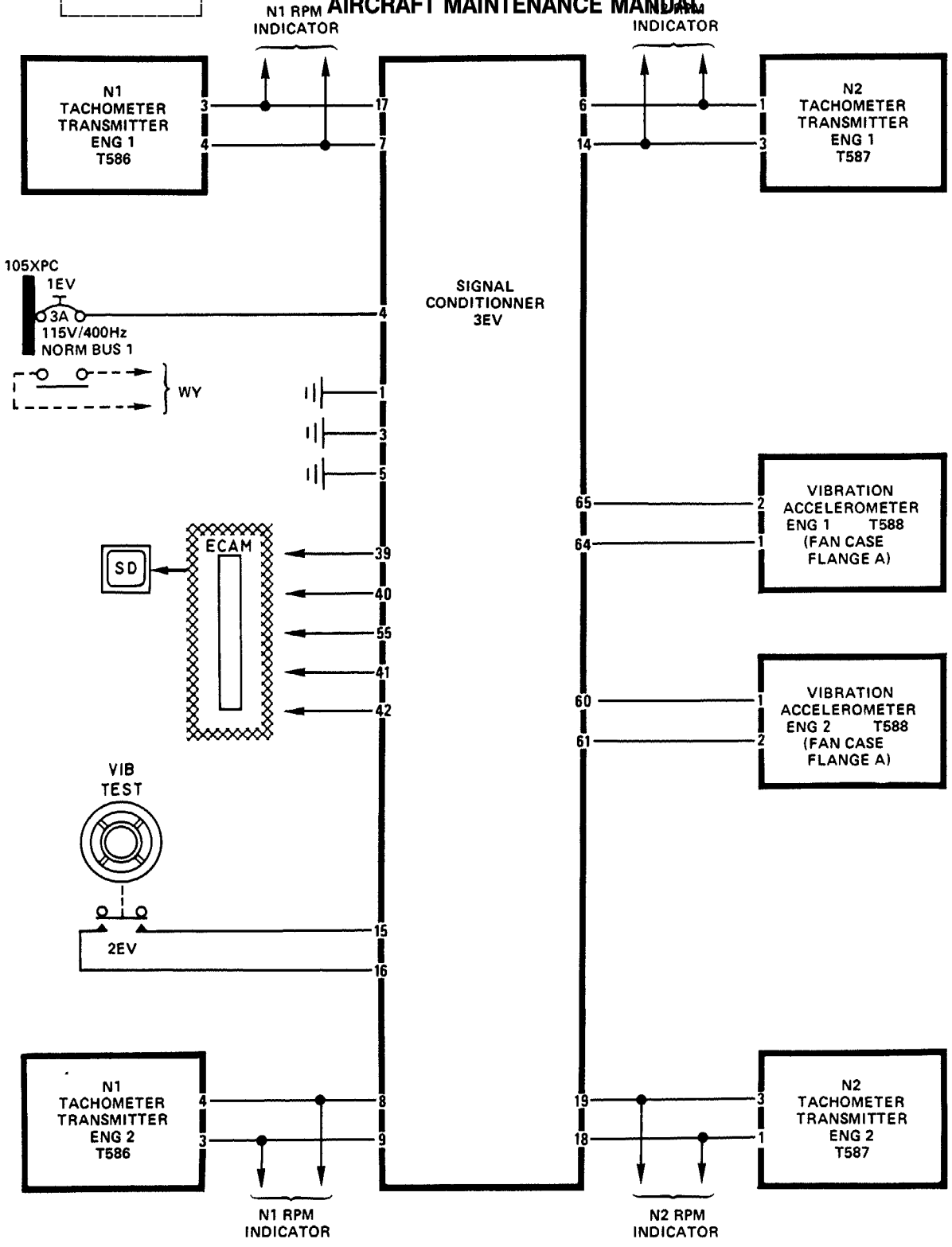
Vibration Indication (R ECAM Display Unit)
Figure 001



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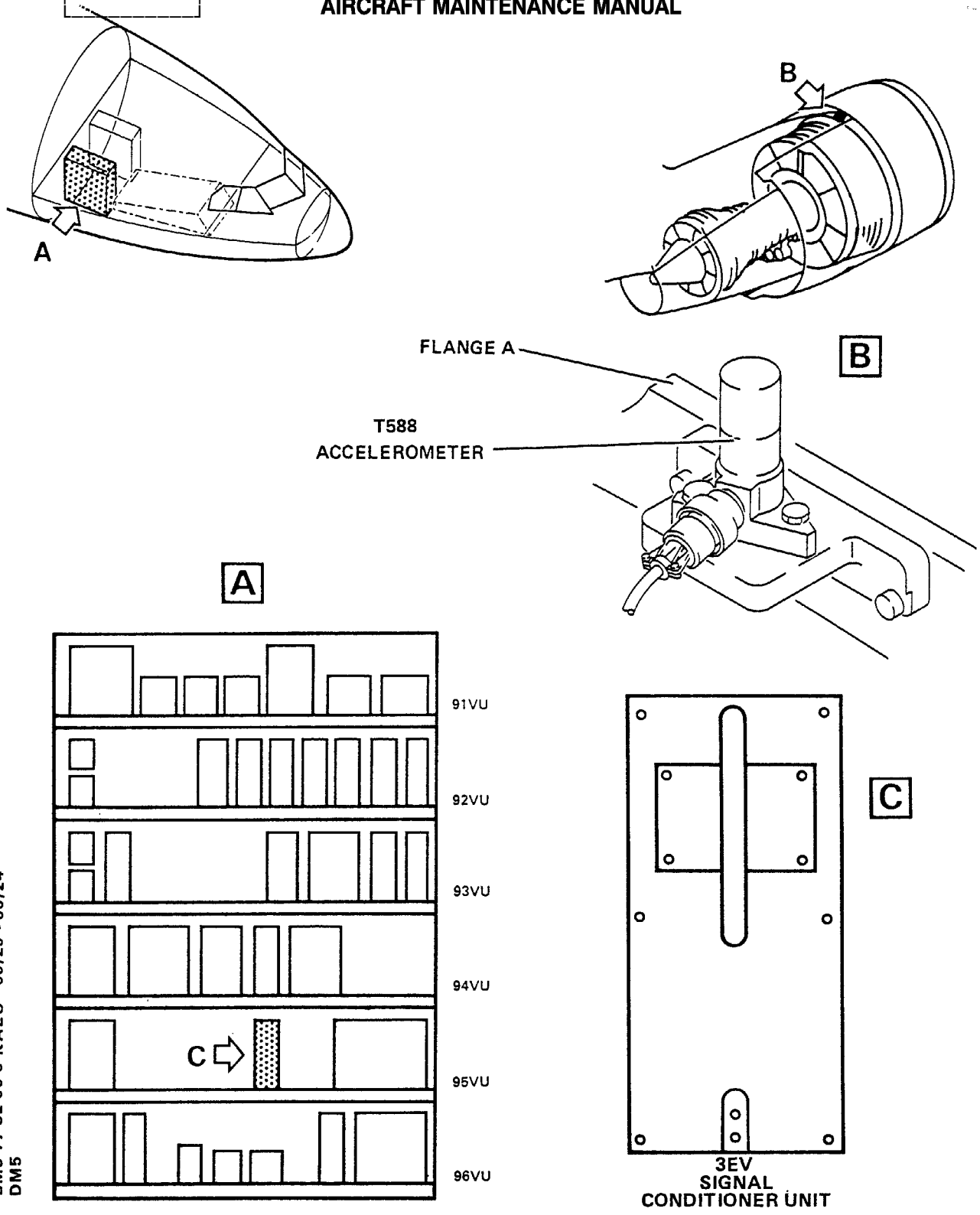
Vibration Indication - Electrical Circuit
Figure 002



Engine Vibration Indicating - Component Location
Figure 003

3. Accelerometers (Ref. Fig. 004)

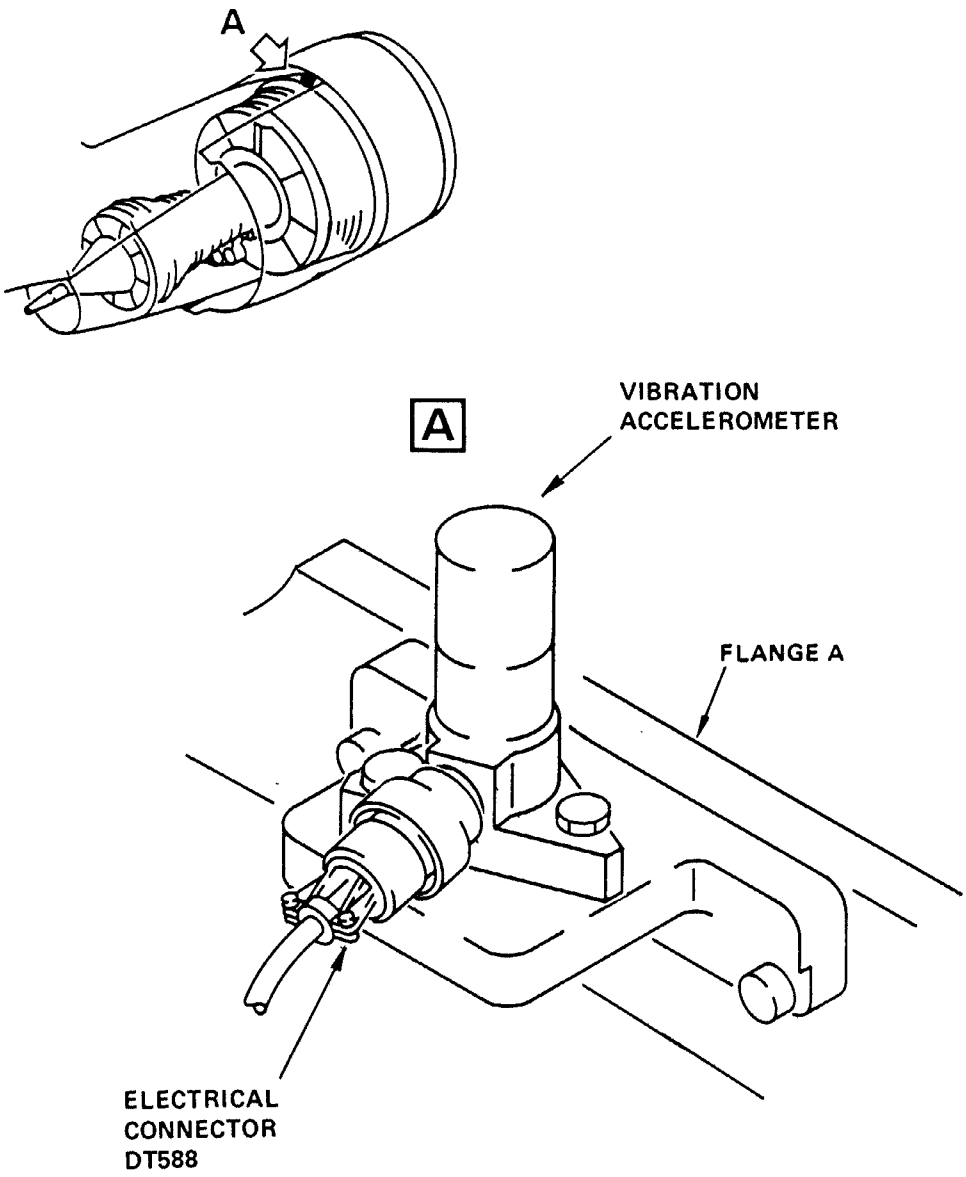
A. The fan case vibration accelerometer is a piezo-electric type accelerometer. The accelerometer sends an electrical signal that is proportional to the engine vibration accelerations. The fan case accelerometer is attached to a flange A bracket at the approximately 12 o'clock position on the fan case. It is attached with three bolts and is connected to a wiring harness.

B. The fan case vibration accelerometer is a standard equipment item. The fan case accelerometer gets input from both the low rotor (N1) vibrations and the high rotor (N2) vibrations. The accelerometer then sends electrical signals to the aircraft for indication on the flight compartment display.

4. Tachometer Transmitter Signals (Ref. Fig. 005)

A. N1 Signal
A tapping from the N1 tachometer transmitter provides an output square wave signal the frequency of which is proportional to N1 speed (100 % N1 = 3600 rpm = 3600 Hz). This signal is sent to a charge amplifier input.

B. N2 Signal
A tapping from the N2 tachometer transmitter provides an output sine wave signal the frequency of which is proportional to N2 speed (100 % N2 = 9900 rpm = 3491.2 Hz). This signal is sent to a charge amplifier input.



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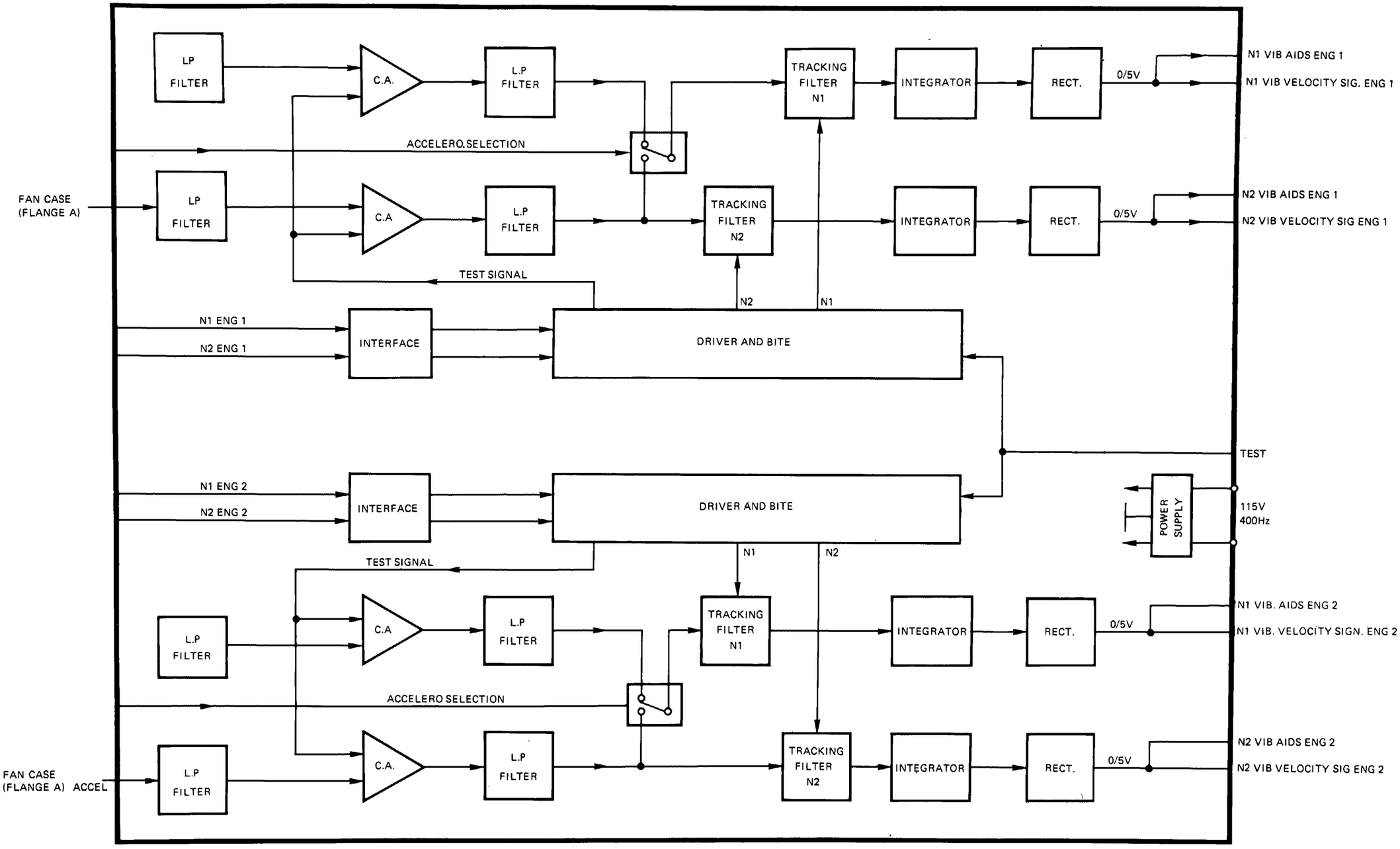
Fan Case Vibration Accelerometer
Figure 004



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Signal Conditioner Block Diagram
Figure 005

5. Signal Conditioner Unit (Ref. Fig. 006)

A. Located in the avionics compartment (rack 90VU, shelf 95VU), the signal conditioner unit (charge amplifier) is an ARINC 404A, 1/4 ATR short type unit, with a modular design. The signal conditioner unit contains three modules : one power supply module and two identical tracking filter channel modules. Each module is plugged in and can be replaced as a separate unit.

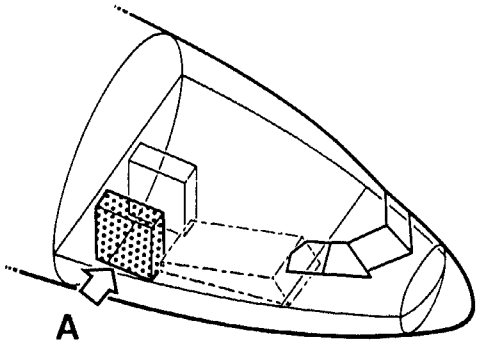
B. Operation
The signal sent by the accelerometer is converted into a voltage signal by a differential converter. The low pass filter rejects vibration signals of no interest for engine condition monitoring (equipment, blade passing vibration).
The signal passes then through two tracking filters which are driven by the corresponding N1 and N2 tachometer signals and are integrated into velocity terms.
These two tracking filters (per engine channel) permanently follow the N1 and N2 1st order frequencies thereby giving conditioner channel outputs proportional to N1 and N2 unbalance.
These two rotor unbalance signals pass through full wave average rectifiers, scaled to give 5VDC for 6 in./sec peak velocity for each output (N1 or N2).

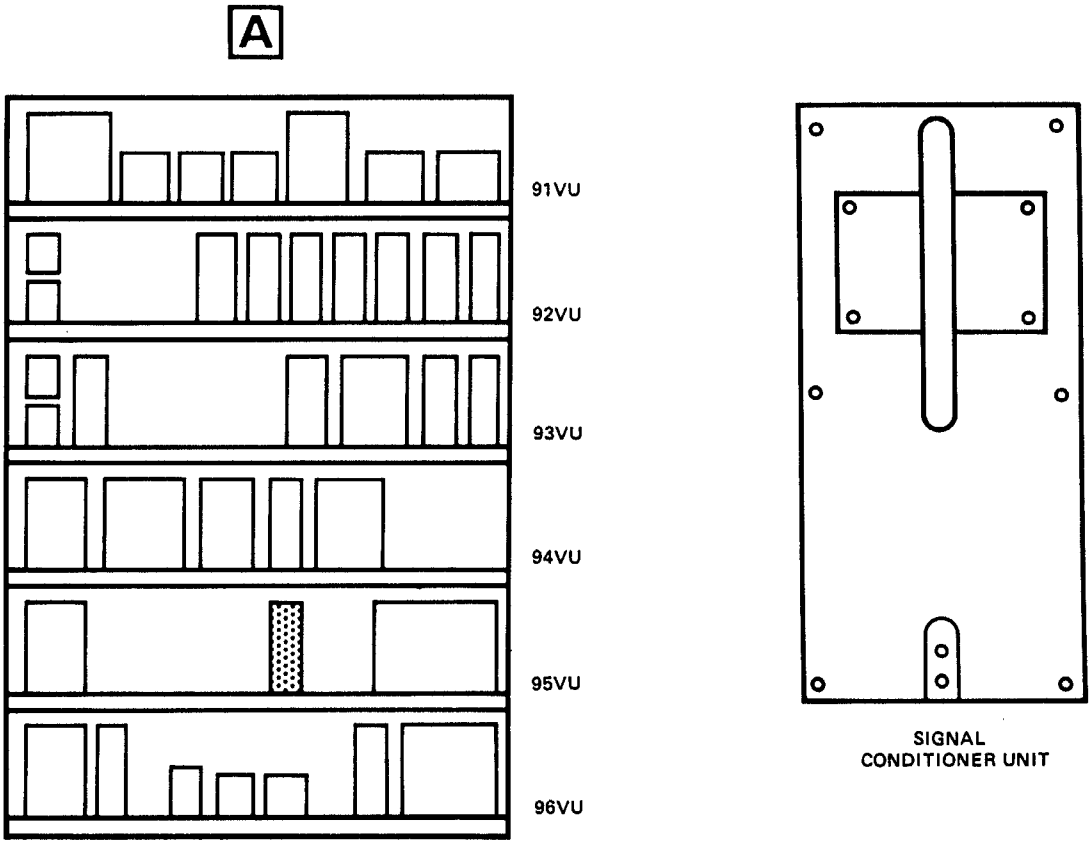
C. Power Supply
The signal conditioner unit is supplied with 115 V/400 Hz from busbar 105XP-C. The power supply module generates and distributes the required voltages to both tracking filter modules.

6. Displays (Ref. Fig. 001)

A. Description
The DC signals (2 per engine) generated by the signal conditioner are transmitted to the SDAC where they are multiplexed and transmitted, by the ARINC 429 data busbar, to the symbol generator unit and ECAM display unit.
Every time the engine message is selected (either automatically or manually), the vibration value will be displayed with two digital data for each engine :
- N1 VIB : displayed without unit from 0 to 10 : 10 corresponds to 6 in./s.
This indication shows the velocity of displacement as sensed by the N1 tracking filter (low pressure rotor vibration).
- N2 VIB : displayed without unit from 0 to 10 : 10 corresponds to 6 in./s.
This indication shows the velocity of displacement as sensed by the N2 tracking filter (high pressure rotor vibration).

B. Operational Usage
(1)Normal usage
In normal conditions, the engine message is displayed as scheduled, except if other messages are called.
The crew only monitors the vibration level and reports any significant





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Signal Conditioner Unit Location
Figure 006

increase (the corresponding engine speed would be a very useful indication for the maintenance personnel).

NOTE : An increasing vibration level is the indication of an incoming problem.

(2)High vibration level

- When any of the two LP rotor indications reaches 3, (advisory level), the engine message is automatically displayed while the corresponding indication flashes on the ECAM display unit. In this case, the crew must retard the engine to reduce the vibration level, and closely monitor the other parameters to detect any engine failure.
- When any of the two HP rotor indications reaches 5, (advisory level), the engine message is automatically displayed while the corresponding indication flashes (green) on the ECAM display unit. In this case, the crew must retard the engine to reduce the vibration level.

7. Engine Vibration Indicating Test

This test performed with the engines shut down determine system operating condition but does not check the accelerometers or accelerometer wiring Nominal value is determined by the generator. Pressing the test switch (2EV), the signal conditioner unit supplies the vibration system (400 mV corresponding to 8 units on the ECAM display unit). The value displayed must be 8 ± 1 units.

ENGINE VIBRATION ACCELEROMETER - REMOVAL/INSTALLATION

1. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Access Platform
C.	Torque Wrench
D.	Corrosion Resistant Steel Lockwire (MS20995C32) (Ref. 70-00-00)
Referenced Procedure - 71-13-00, P. Block 301	Cowl Doors

2. Procedure (Ref. Fig. 401)

A. Job Set-Up
(1)Open, safety and tag the following circuit breaker :

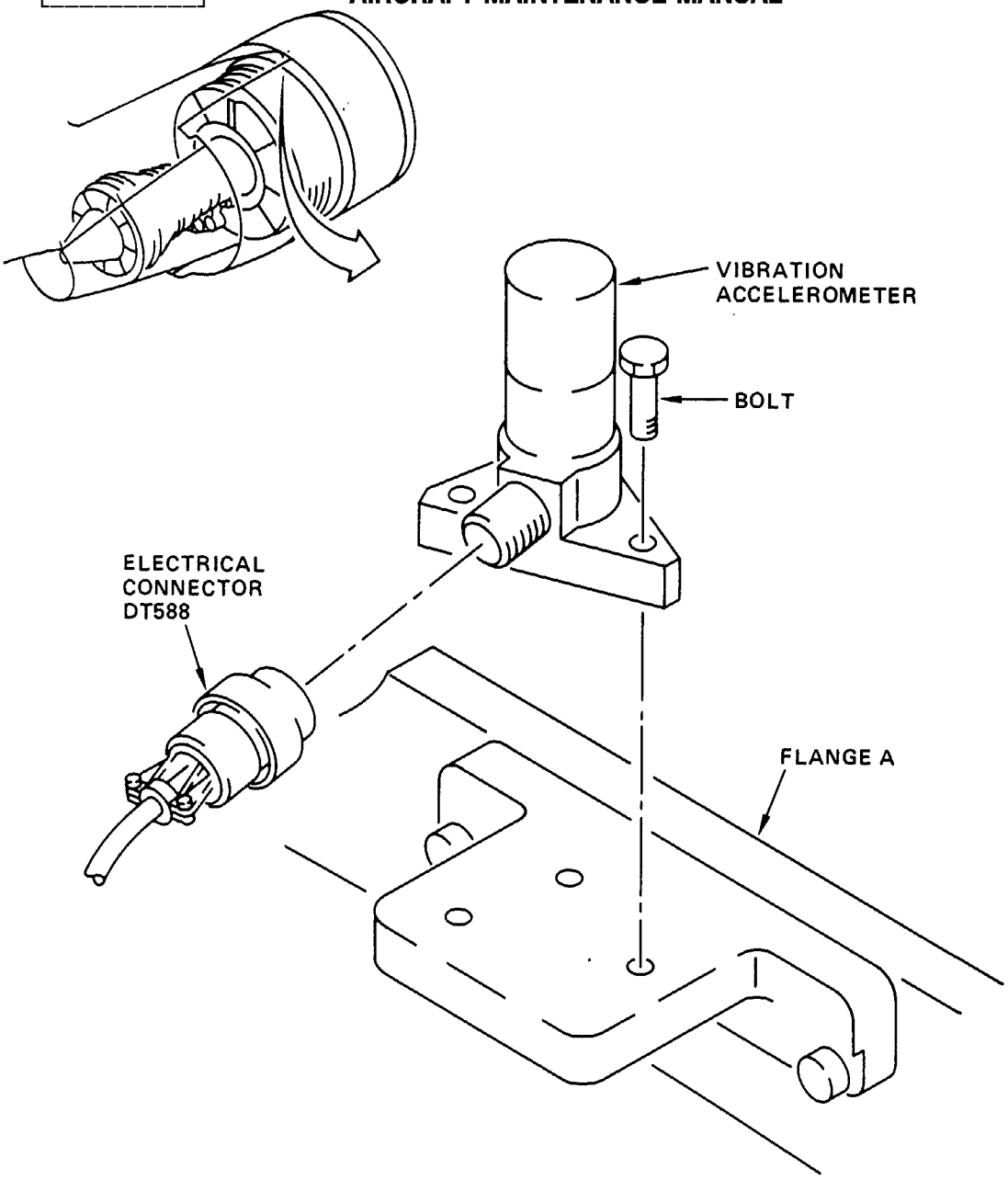
PANEL	SERVICE	IDENT.	LOCATION
R 133VU	ENGINES - ENG1 & 2 VIB	1EV	334/S71

(2)Open safety and tag the appropriate circuit breakers and open RH fan cowl door. (Ref. 71-13-00, P. Block 301).
(3)Install access platform.

B. Removal
(1)Disconnect electrical connector DT 588 from accelerometer.
(2)Remove bolts and lockwire attaching accelerometer to bracket and remove accelerometer.

C. Installation
(1)Install vibration accelerometer on fan case Flange A bracket with screws. TORQUE screws to between 12 and 15 lbf.in. (0.14 and 0.17 m.daN) and wirelock.
(2)Connect electrical connector DT 588 to accelerometer and TORQUE to between 66 and 100 lbf.in. (0.75 and 1.13 m.daN).

D. Close-Up
(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(2)Remove access platform.
(3)Remove safety clips and tags and close circuit breakers 1EV.
(4)Remove safety clips and tags and close circuit breakers. Close RH from cowl door (Ref. 71-13-00, P. Block 301).



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Vibration Accelerometer
Figure 401

ENGINE VIBRATION SIGNAL CONDITIONER UNIT - REMOVAL/INSTALLATION

1. General

The engine vibration signal conditioner unit is installed in the avionics compartment, rack 90VU, shelf 95VU.

2. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Blanking Caps/Plugs
Referenced Procedure - 24-41-00, P. Block 301	AC External Power Control

3. Procedure

A. Job Set-Up

(1)Open, safety and tag the following circuit breakers :

PANEL	SERVICE	IDENT.	LOCATION
133VU	ENGINES/ENG1 & 2/VIB	1EV	334/S71

B. Removal (Ref. Fig. 401)

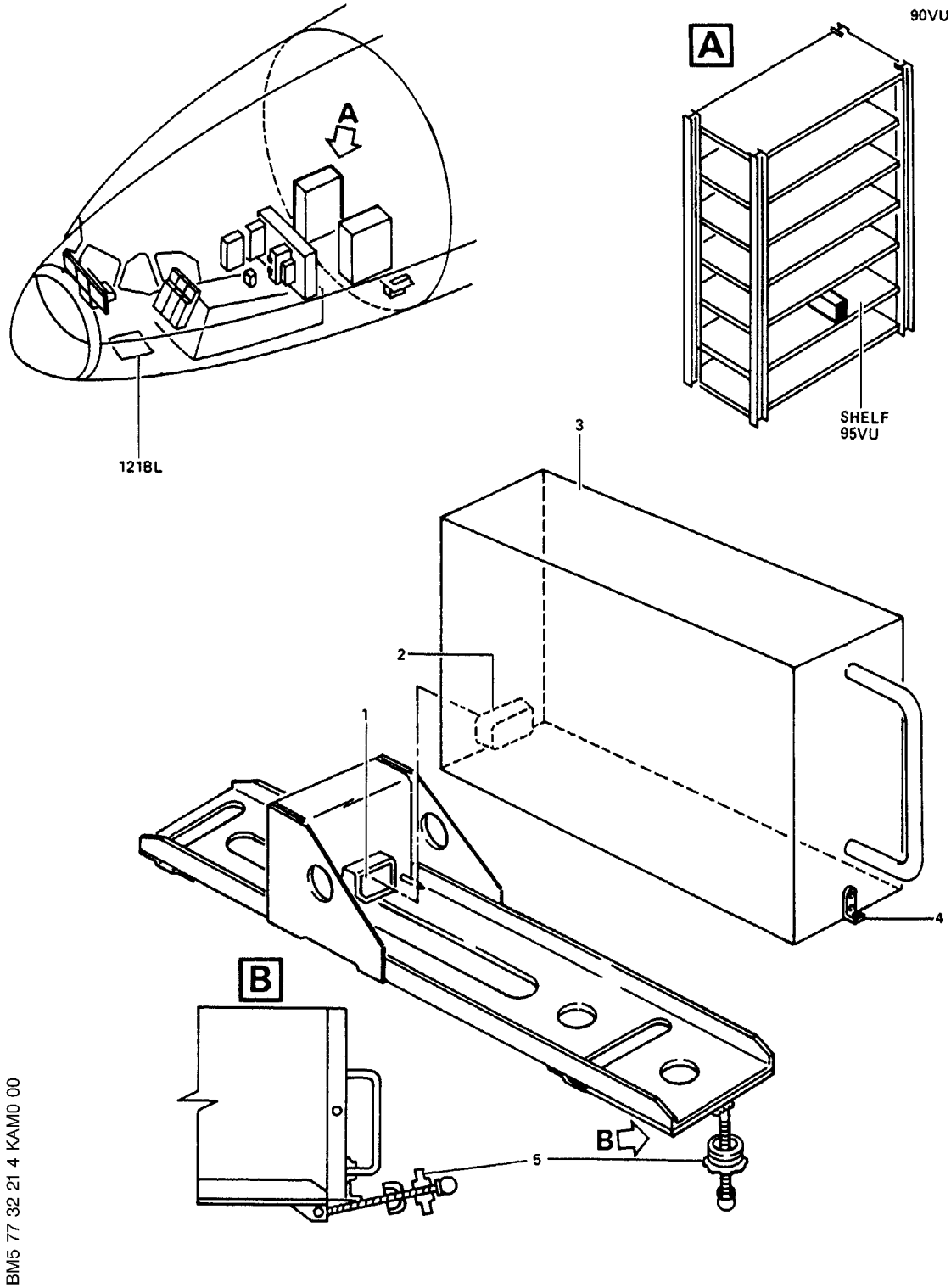
(1)Loosen knurled retaining nut (5) until stud (4) is freed.
(2)Withdraw signal conditioner unit (3) from mount by lightly pulling handle so as to free back connector (1) and centering pins.
(3)Cap electrical connectors (1) on mount and electrical connector (2) on signal conditioner unit.

C. Installation (Ref. Fig. 401)

(1)Clean and inspect signal conditioner unit interface and mount.
(2)Remove blanking caps from electrical connector (1) on mount and electrical connector (2) on signal conditioner unit.
(3)Check electrical connectors and locating pins for correct condition.
(4)Push in signal conditioner unit slowly on mount, making certain that electrical connectors and locating pins insert correctly.
(5)Lift knurled retaining nut (5) into position on stud (4).
(6)Tighten knurled retaining nut (5) until signal conditioner unit is fully home.
(7)Remove safety clip and tag and close circuit breaker 1EV.

D. Test

(1)Energize the aircraft electrical network (Ref. 24-41-00, P. Block 301).
(2)Make certain that electronics rack ventilation is correct.
(3)Make certain that ECAM circuit breakers are closed.
(4)On center pedestal, ECAM control panel, select ENGINE page by pressing ENG pushbutton switch.
(5)On lateral panel 472VU, press VIB TEST pushbutton switch.
(6)On R ECAM display unit check that :



Signal Conditioner Unit
Figure 401

VIB (N1) : 8 CPU ± 1 CPU
VIB (N2) : 8 CPU ± 1 CPU.

E. Close-Up
(1)De-energize the aircraft electrical network (Ref. 24-41-00, P. Block 301).